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The millipede family Paradoxosomatidae on Borneo, with contributions to the faunas of some other islands of the Sunda area (Diplopoda, Polydesmida)

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The millipede family Paradoxosomatidae on Borneo, with contributions to the faunas of some other islands of the Sunda area (Diplopoda, Polydesmida). – Several fresh collections of paradoxosomatid millipedes from the Indo-Australian archipelago, mainly Borneo, comprise 14 species and two genera new to science: *Euphyodesmus reductus* sp. n., *E. perarmatus* sp. n., *E. lobatus* sp. n., *E. lateridens* sp. n., *Borneochiropus spinitergus* sp. n. (both genera allocated within the chiefly Australian tribe Antichiropodini), *Orangutana setosa* gen. n., sp. n. (Orthomorphini), *Arthrogonopus proletarius* sp. n., *Opisthodolichopus bifidus* sp. n., *Margaritosoma borneorum* sp. n., *Dajakina longipes* sp. n., *Kalimantanina crucifera* sp. n., *K. bruneica* sp. n., all from Borneo, as well as *Gigantomorpha mutilata* sp. n., from Bali, and *Margaritosoma singaporense* sp. n., from Singapore. Notes on the variation range of *Gigantomorpha immanis* Jeekel, 1963, are given. *Tectoporus filarius* (Attems, 1932), has been rediscovered on Java, *Opistodolichopus scandens* Hoffman, 1973, in Singapore, and *Tectoporus pygmaeus* (Pocock, 1894), hitherto reported solely from Java, has been recorded in Bali for the first time. Keys to the tribes and genera of Paradoxosomatidae encountered on Borneo as well as to species of the genera *Arthrogonopus* Jeekel, 1963, *Dajakina* Jeekel, 1963, *Euphyodesmus* Attems, 1931, *Gigantomorpha* Jeekel, 1963, *Margaritosoma* Jeekel, 1979, *Kalimantanina* Jeekel, 1963, and *Opisthodolichopus* Verhoeff, 1941, have been compiled. A review of the Bornean paradoxosomatid fauna is presented coupled with brief zoogeographical comments.

Key-words: Paradexosomatidae - fauna - taxonomy - keys - Borneo - Sunda Archipelago.

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INTRODUCTION

The millipede fauna of Southeast Asia, both continental and insular, is strongly dominated by species of the large family Paradoxosomatidae. Yet the fauna of Borneo, one of the biggest islands in Australasia, remains highly insufficiently known. Only very few papers have been specially or mainly devoted to Bornean paradoxosomatids, all by JEEKEL (1963, 1983a, 1983b), with the result that a total of 30 acknowledged species and nine genera have hitherto been reported from that great island. I guess that actually several times as many species await discovery on Borneo.

The present paper focuses on part of a considerable millipede collection from Borneo managed recently during several trips by Dr. Daniel Burckhardt, Dr. Bernd Hauser and Dr. Charles Lienhard, all from the Muséum d'Histoire naturelle in Geneva (MHNG). This contribution is restricted to the Paradoxosomatidae, hence providing an excellent opportunity to review and key the entire Bornean fauna of that family as well as to briefly discuss some zoogeographical issues. In addition, several sporadic samples taken by the above collectors on a few other islands of the Sunda area on their way to and back from Borneo have been incorporated in this study as well. Besides, one more Bornean specimen representing a new species and recently collected by Dr. Ottó Merkl, of the Hungarian Natural History Museum in Budapest (HNMB), has been added here too, bringing the paradoxosomatid fauna of Borneo to a total of 42 species and 12 genera.

Only a few duplicates have been retained by the author for a subsequent deposition in the collection of the Zoological Museum of the Moscow State University (ZMUM), whereas the bulk of material has been returned to MHNG or HNMB, as indicated hereinafter.

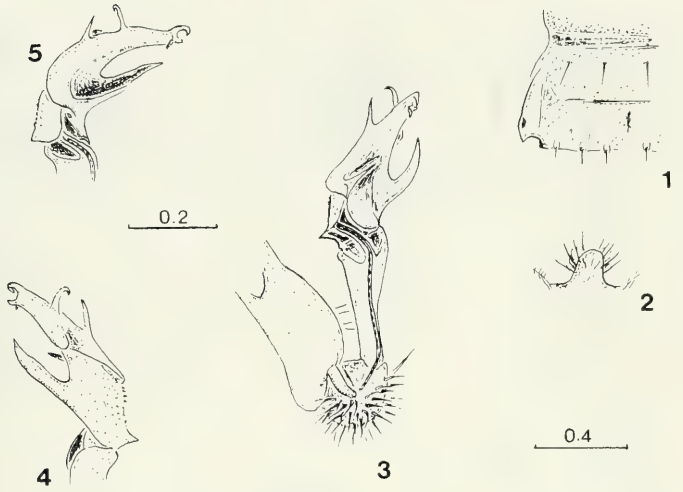
TAXONOMIC PART.

Tectoporus filarius (Attems, 1932) (Figs 1-5)

Material: 1 ♂, 2 ♀ (MHNG), 1 ♂, 1 ♀ (ZMUM), Indonesia, Java: Cibodas, *Lithocarpus-Castanopsis* forest along ravine above Botanical Gardens, 1350–1480 m, beaten from vegetation, 25.XI.1987 (Sar-87/16). – 1 ♂, 1 ♀ (MHNG), same locality, lower part of Botanical Gardens, ca. 1250–1300 m, beaten from vegetation, 27.XI.1987 (Sar-87/28), all leg. C. Lienhard.

Remarks: The above material corresponds virtually fully to the original description (ATTEMS 1932) and the only subsequent record (CHAMBERLIN 1945), as seen from Figs 1-5. The only minor discrepancy concerns the presence both of very poorly developed tubercles supporting the caudal row of tergal setae and a short axial line behind the transverse sulcus (Fig. 1). However, the above variation in metatergal sculpture can fairly well be considered as individual or populational, for the gonopod structure is identical.

This species has hitherto been known only from West Java (see review: JEEKEL 1951), and the above material actually derives from the locus typicus: Cibodas (= Tjibodas).



FIGS 1–5

Tectoporus filarius (Attems, 1932), ♂: 1 – somite 10, dorsal view; 2 – sternal lamina between ♂ coxae 4, caudal view; 3 – left gonopod, mesal, lateral, and dorsal views, resp. – Scales in mm.

Tectoporus pygmaeus (Pocock, 1894) (Figs 6-14)

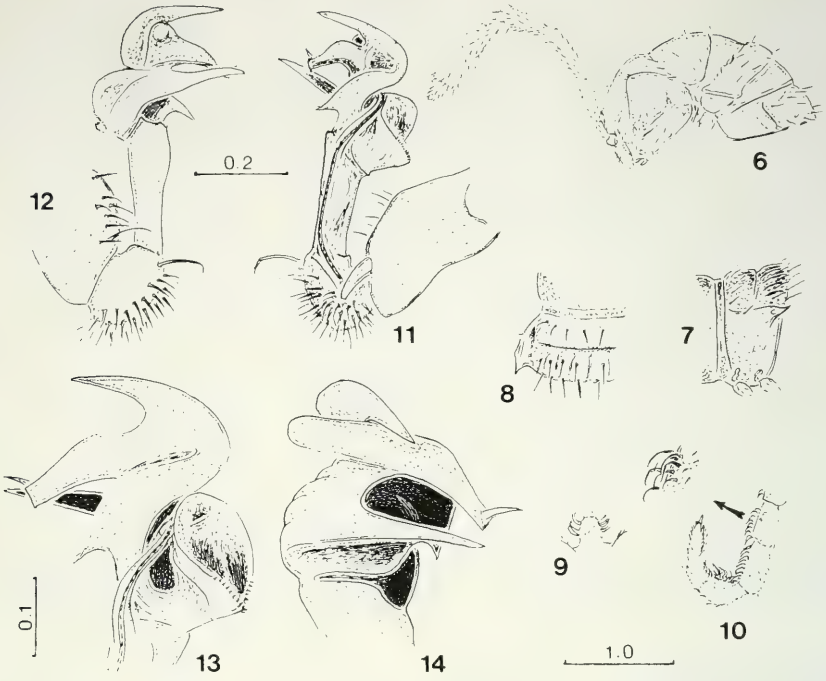
Material: 1 ♂ (NHMG), Indonesia, Bali: Bedugul, Botanical Gardens, 1230–1260 m, forest and especially in hothouses, 30.IX.1987 (Sar-87/35); leg. B. Hauser. – 2 ♂, 2 ♀ (NHMG), 2 ♂ (ZMUM), same locality, forested part, 1230–1260 m, beaten from vegetation, 30.XI.1987 (Sar-87/36); leg. C. Lienhard.

Remarks: Like the preceding species, *T. pygmaeus* has hitherto been known only from West Java (see reviews: JEEKEL 1951, 1968, 1979a), being new to the fauna of Bali. Like the previous case, in spite of minor variations in some peripheral and even gonopodal characters (POCOCK 1894; ATTEMS 1903, 1937; CHAMBERLIN 1945), the new illustrations (Figs 6-14) leave no doubt that the above new material belongs to *T. pygmaeus*. Moreover, introduction cannot be ruled out, since at least part of material could have derived from hothouses.

In addition to *T. pygmaeus*, five paradoxosomatid species have been encountered on Bali, viz. both anthropochorous *Orthomorpha coarctata* (de Saussure 1860), and *Chondromorpha xanthotricha* (Attems 1898) (JEEKEL 1983b), as well as the probably endemic *Orthomorpha baliorum* Golovatch, 1994, *Margaritosoma baliorum* Golovatch, 1994 (GOLOVATCH 1994b), and *Gigantomorpha mutilata* sp. n. (see below).

Euphyodesmus reductus sp. n. (Figs 15-18)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah, West Coast Residency, Mt Kinabalu, "Bukit Ular Trail", 1790 m, sifted leaf litter and rotten wood in *Lithocarpus-Castanopsis* forest, extracted with Winkler-Moczarski eclector, 28.IV.1982 (Sab-82/15); leg. B. Hauser.



FIGS 6-14

Tectoporus pygmaeus (Pocock, 1894), ♂: 6 – anterior body portion, lateral view; 7-8 – somite 10, lateral and dorsal views, resp.; 9 – sternal lamina between ♂ coxae 4, caudal view; 10 – leg 3; 11-12 – right gonopod, mesal and lateral views, resp.; 13-14 – distal part of right gonopod, ventromesal and subfrontal views, resp. – Scales in mm.

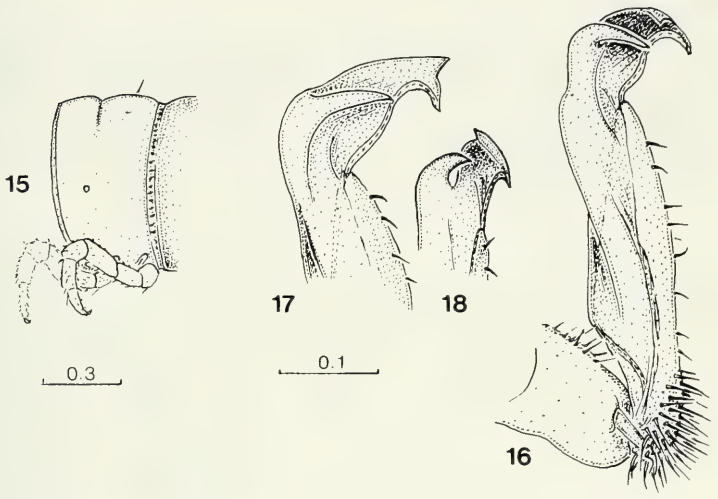
Etymology: The species epithet refers to the drastically reduced paraterga and gonopod telopodite distally of the prefemoral portion.

Diagnosis: Differs from congeners by the especially poorly developed paraterga and gonopod tibiotarsus as well as by the particularly short antennae and legs.

DESCRIPTION

Length ca. 8 mm, maximal width 0.75 mm on midbody somites and 0.8 mm on head. Coloration uniform pale brownish, anterior third of body a little brighter. Antennae only distally, but not apically, brownish. Legs, ventrum and a few basal antennomeres yellowish-whitish.

Head a bit broader than subequally wide collum and somites 5-17. Postcollar constriction evident on subequally narrowest somites 2-4. Body distinctly moniliform, rather rapidly tapering caudad on somites 18-20. Antennae short, quite clavate, in situ



FIGS 15-18

Euphyodesmus reductus sp. n., ♂ holotype: 15 – somite 10, lateral view; 16 – left gonopod, mesal view; 17-18 – tip of left gonopod, subdorsal and ventromesal views, resp. – Scales in mm.

reaching to end of somite 2. Paraterga almost entirely missing, very weakly displayed as small and low ridges on somite 2, hardly traceable due to outlining sulci from above and below on somites 3–4, onward as trace sulci only from above on somites 5–6, further caudad as poor swellings (Fig. 15). Ozopores lying very low. Surface shining, smooth. Somites deeply constricted, suture dividing pro- and metazona deep, strongly striate longitudinally. Transverse metatergal sulcus starting from somite 5, rather deep, thin and lineiform, missing on somite 19. Tergal setae rather short, a few on collum, 2+2 setae on somite 2, 1+1 presulcus ones on further somites but telson (Fig. 15). Pleurosternal keels absent. Epiproct moderately long, somewhat flattened dorsoventrally, in lateral view almost straight, from above subtriangular, rather broadly truncate. Subanal scale subtrapeziform, with a pair of indistinct, setiferous, paramedian knobs at a rather wide caudal margin.

Sterna virtually bare, strongly shining, with a big, linguiform, setose, lamina directed forward between coxae 4. Legs short, rather stout, with neither adenostyles nor tarsal brushes, prefemora and femora with dense, strong, setae adpressed distad.

Gonopods (Figs 16-18) suberect. Coxite rather long, ventrally setose. Telopodite with evidence of torsion, prefemoral part unusually prominent, perhaps the most prominent not only among congeners, but also among all Paradoxosomatidae. Seminal groove running mostly laterally, shifting laterad already parabasally. Distal part of tibiotarsus with a simple, mesal, distofemoral tooth and a bifid lateral lobe with proximalmost tooth supporting seminal groove.

Euphyodesmus perarmatus sp. n. (Figs 19–24)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sarawak: SE of Serian, Sabal (= Forest Research Station), 190 m, beaten from vegetation, 10.XII.1987 (Sar-87/72); leg. C. Lienhard. – Paratypes: 1 ♀, 1 juv. (MHNG), same data, together with holotype. 1 ♀ (MHNG), same locality, 180 m, under bark, 10.XII.1987 (Sar-87/71); leg. B. Hauser.

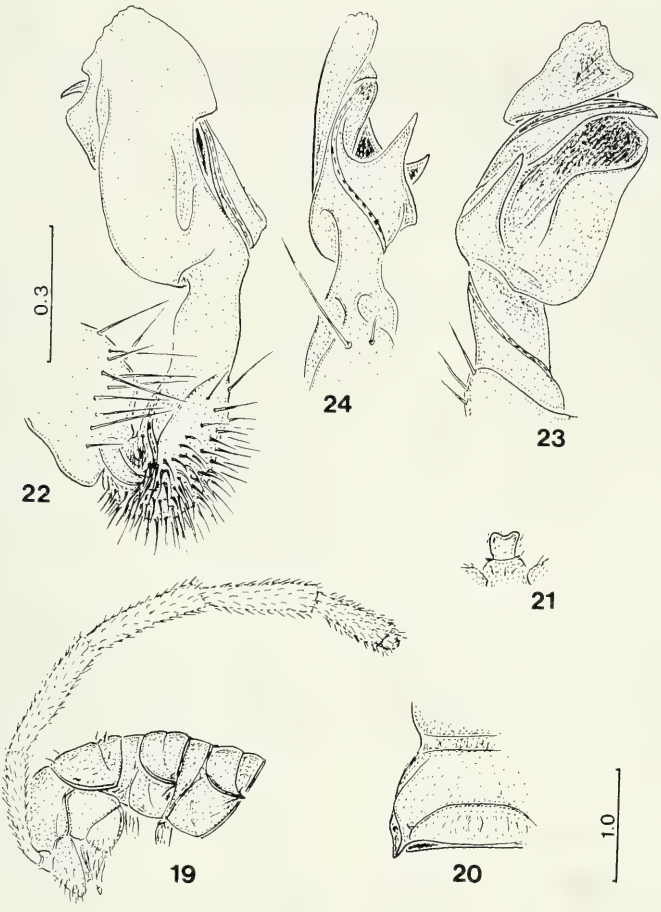
Diagnosis: Differs from congeners by the especially strongly developed gonopod tibiotarsus.

Description

Length ca. 21 mm, maximal width 1.1 and 1.5 (♂) and 1.1–1.2 and 1.5-1.6 mm (♀) on midbody pro- and metasomites, respectively. Coloration rather uniform dark chocolate-brown to blackish, ventrum and a few distal podomeres only a little paler, only paraterga, tips of antennae and a few proximal podomeres whitish.

Head considerably broader than narrowest collum, but a bit narrower than somite 5. Body distinctly moniliform, gradually broadening toward somite 5, parallel-sided on somites 5–17, onward rather gently but rapidly tapering. Antennae very long, slender (Fig. 19), in situ surpassing somite 5 (♂) or 4 (♂). Paraterga rather poorly developed, set at about 1/3–1/4 midbody height, directed somewhat obliquely dorso-caudad, only occasionally (on pore-bearing somites) level to dorsum, usually well below dorsum, starting already from collum, as narrow (poreless somites) or somewhat broader (pore-bearing somites) ridges, from above invariably narrowly rimmed laterally. Caudal corner of paraterga roundly subrectangular on collum, narrowly rounded on somite 2, onward invariably beak-shaped and spiniform (Fig. 20), reaching to slightly surpassing rear tergal contour, strongly surpassing the contour only on somites 17-18, almost vestigial on 19th. Lateral rim of paraterga with one or two minute incisions on pore-bearing and poreless somites, gradually coming (almost) to naught toward midbody somites. Ozopores dorsolateral, inside an oblique groove. Surface shining, generally smooth, uniform delicately shagreened, only postsulcus halves of metaterga slightly rugulose and metazona 2–5 below paraterga coarsely shagreened. Somites deeply constricted, suture dividing pro- and metazona deep, smooth. Transverse metatergal sulcus starting already from collum, rather deep, thin, arching and lineiform (Fig. 20), only traceable on somite 19. Tergal setae medium-sized, mostly missing, a few on collum, onward a pattern of 2+2 setae in presulcus row, of which only 1+1 median remain. Pleurosternal keels absent, as a vestigial oblique ridge on somite 2 and poor swellings on somites 3-4. Epiproct moderately long, somewhat flattened dorsoventrally, in lateral view almost straight, from above conical, narrowly truncate, with two minute apical papillae and preapical incisions removed very far from tip. Subanal scale subtriangular, with a pair of rather indistinct, setiferous, paramedian knobs at a rather widely rounded caudal margin.

Sterna almost bare, with distinct cross-impressions and a big, linguiform, setose, slightly emarginate lamina directed anteroventrally between coxae 4 (Fig. 21). Legs very long, slender, growing considerably longer toward caudal body end, with neither adenostyles nor tarsal brushes, relatively sparsely setose even ventrally, distinctly longer and slightly incrassate in ♂ as compared to ♀.



FIGS 19-24

Euphyodesmus perarmatus sp. n., ♂ paratype: 19 – anterior body portion, lateral view; 20 – somite 10, dorsal view; 21 – sternal lamina between ♂ coxae 4, caudal view; 22-24 – left gonopod, mesal, lateral, and ventral views, resp. – Scales in mm.

Gonopods (Figs 22-24) relatively complex. Coxite rather short and stout, distally setose. Telopodite with evidence of torsion, prefemoral part not particularly prominent, femorite stout and subcylindrical. Seminal groove running mostly laterally, shifting laterad already parabasally. Tibiotarsus unusually big and complex, subcyathiform, almost sheathing solenomerite, latter with a strong parabasal distofemoral tooth.

Euphyodesmus lobatus sp. n. (Figs 25-30)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sarawak: Kuching-Serian road, near Kampong Kuap (18 km from Kuching), secondary forest, 30 m, beaten from vegetation, 13.XII.1987 (Sar-87/88); leg. C. Lienhard.

Diagnosis: Differs from congeners by the especially strongly reduced gonopod tibiotarsus.

Description

Length ca. 18 mm, maximal width 1.0 and 1.25 (♂) on midbody pro- and metasomites, respectively. Coloration dark brown to blackish, pattern like in *E. perarmatus*.

Head and body (Figs 25–28) like in *E. perarmatus*, except for the following characters. Paraterga set somewhat higher, at about 1/4–1/5 midbody height, with caudal spike mostly slightly elevated above or at least level to dorsum on posterior body half. Incisions on metaterga a little more distinct, especially on anterior body half, gradually coming to naught until somite 17. Metatergal sulcus poorly traceable already on somite 18, virtually missing on somite 19. Pleurosternal carinae present as a small but distinct tooth only on somite 2, vestigial on somite 3. Epiproct also narrowly truncate, but with a pair of big apical papillae divided by a very narrow notch. Subanal scale semicircular, more strongly rounded at caudal margin.

Gonopods (Figs 29–30) relatively simple. Coxite short and stout, distally setose. Prefemoral portion very big, femorite very strongly reduced, with a distodorsal lobe at base of a relatively slender and apically unciform solenomerite, tibiotarsus virtually totally missing.

Euphyodesmus lateridens sp. n. (Figs 31-36)

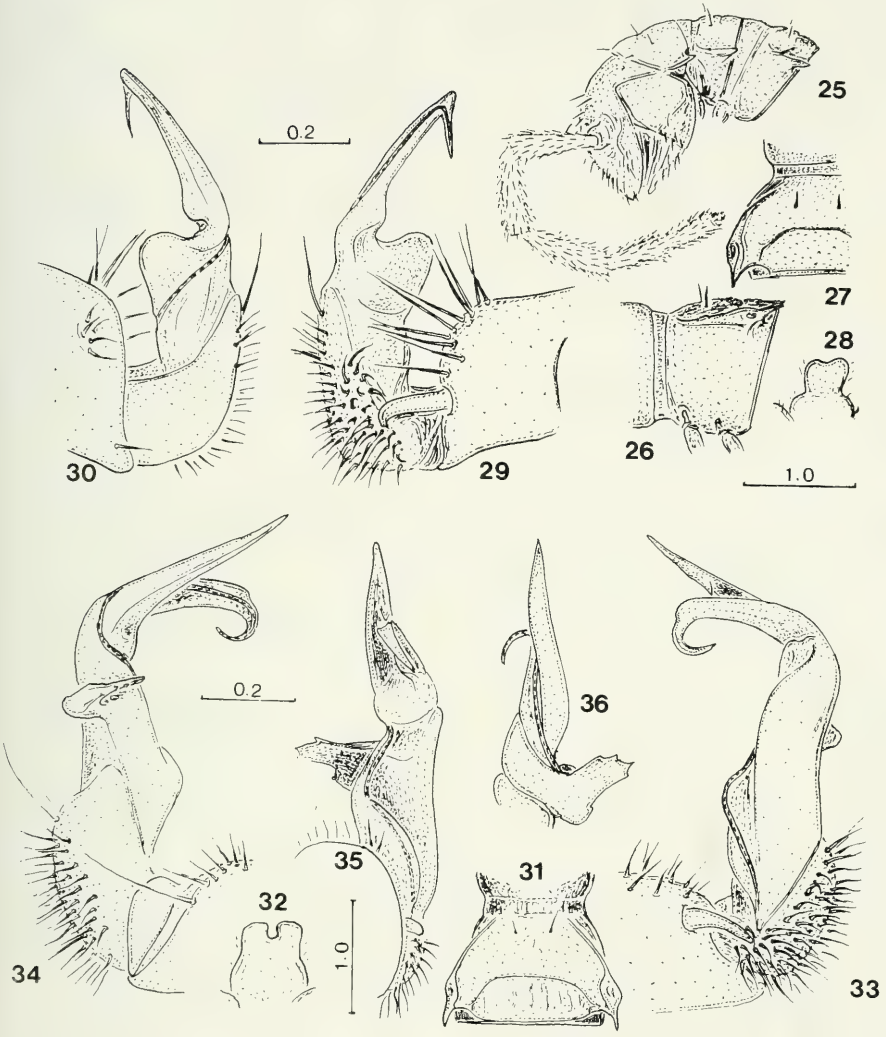
Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sarawak: Kuching-Matang road, Mt Gunung Serapi, forest along road toward TV station, 700 m, beaten from vegetation, 9.XII.1987 (Sar-87/67); leg. C. Lienhard. – Paratypes: 1 ♂, 2 juv. (19 segm.) (MHNG), 1 ♂ (ZMUM), same data, together with holotype. – 1 ♂ (MHNG), Sarawak: Bau, near cave "Gua Puang" near Kampong Pelaman Sekiang on a steep slope of Gunung Jambusan ("Pang Cave" in Wilford, 1964), 10-30 m, beaten from vegetation, 4.XII.1987 (Sar-87/51); leg. C. Lienhard.

Diagnosis: Differs from congeners both by characteristic distolateral tooth of the gonopod and sternal lamina between the ♂ coxae 4.

Description

Length ca. 20–21 mm, maximal width 1.1-1.2 and 1.6-1.7 mm on midbody pro- and metasomites respectively. Coloration dark brown to blackish, pattern like in *E. perarmatus*.

Head and body (Fig. 31) like in *E. perarmatus*, except for the following characters. Paraterga set relatively high, like in *E. lobatus*, mostly below or level to dorsum, only seldom spikes surpassing dorsum, slightly surpassing rear tergal contour already from somite 5, only from somite 4 pointed, before more or less narrowly



FIGS 25-36

Euphyodesmus lobatus sp. n., ♂ holotype (25-30), and *Euphyodesmus lateridens* sp. n., ♂ paratype (31-36): 25 – anterior body portion, lateral view; 26, 27 & 31 – somite 10, lateral, dorsal, and dorsal views, resp.; 28 & 32 – sternal lamina between ♂ coxae 4, caudal view; 29-30 – right gonopod, mesal and lateral views, resp.; 33-36 – left gonopod, mesal, lateral, dorsal, and ventral views, resp. – Scales in mm

rounded, especially well-protruding on somites 16-18. Metatergal sulcus rather well-developed also on somite 18, virtually missing on somite 19. Pleurosternal carinae present only as small but distinct teeth on somites 2-3. Epiproct also rather narrowly truncate, apical papillae indistinct, preapical incisions very strongly removed from tip. Subanal scale as a very narrowly truncate trapeze or triangle. Lamina between ♂ coxae 4 particularly big and strongly notched in the middle (Fig. 32).

Gonopods (Figs 33-36) relatively complex. Coxite short and stout, distally setose. Prefemoral portion very prominent, femorite strongly reduced, with a characteristic, distolateral, scapuliform, serrate tooth at base of both a big, spiniform tibiotarsus and a strong, distally unciform solenomerite.

Remarks: The genus *Euphyodesmus* Attems, 1931, has hitherto been known to comprise only three species, all confined to Borneo: *E. gracilis* Attems, 1931 (the type-species), *E. postfemoralis* Jeekel, 1963, and *E. granulifer* Jeekel, 1963 (Jeekel 1963). Discovery in Sabah and Sarawak of four additional congeners reported here at once seems to evidence that *Euphyodesmus* is perhaps far more species-rich, with further new members still to be found.

The gonopod traits of all four new congeners are clearly those characteristic of *Euphyodesmus*, while certain amendments in the concept of the genus, such as the degree of development and caudal projection of the paraterga, presence of tarsal brushes, length of antennae and legs, etc. (Jeekel 1963), concern only some relatively unimportant peripheral features.

Formally, *Euphyodesmus* has hitherto been referred to the tribe Tectoporini, yet with certain reservations (Jeekel 1963, 1968). With new evidence at hand, in particular in view of the discovery of the new monobasic genus *Borneochiropus*, that allocation appears false and actually refers to the tribe Antichiropodini (see just below).

All currently known *Euphyodesmus* species can be separated using the following key:

1(2) Metaterga with two transverse rows of knobs, presulcus one setiferous, and postsulcus one bare. Gonopod suberect, tibiotarsus as a big, simple lamina a little shorter than a bifurcate solenomerite. . . . . *E. granulifer*

2(1) Metaterga without knobs, either hairless or with a single presulcus row of setae. Gonopod either strongly enlarged or strongly reduced distally, often unciform not suberect; tibiotarsus either strongly reduced, often denti- or spiniform, or strongly folded and complex in shape.

3(4) Antennae relatively short, in situ reaching only the end of somite 2 dorsally. Paraterga strongly reduced, virtually missing on somites 7–19 (Fig. 15). Legs relatively short and stout (Fig. 15). Gonopod prefemoral part hypertrophied out of all proportions, both tibiotarsus and solenomerite simple, dentiform, strongly reduced (Figs 6–18). . . . . *E. reductus*

4(3) Antennae and legs considerably longer. Paraterga always present, mostly spiniform caudally. Gonopod prefemur never so strongly hypertrophied, both tobiotarsus and solenomerite never so strongly reduced.

5(6) Paraterga relatively underdeveloped (Figs 19-20), usually well below dorsum, set at 1/3–1/4 midbody height, only their caudal spikes sometimes scarcely reaching the level of dorsum. Transverse sulcus still traceable on metasomite 19. Gonopod tibiotarsus hypertrophied, solenophore-like (Figs 22–24). . . . . *E. perarmatus*

6(5) Paraterga better developed, set mostly at 1/4–1/5 midbody height, almost to fully level to dorsum. No transverse sulcus on metasomite 19. Gonopod tibiotarsus never solenophore-like, nor sheathing solenomerite.

7(10) Suture dividing pro- and metazona striate, although quite indistinct. Gonopod tibiotarsus strongly folded, complex in outline.

8(9) Head only a little wider than collum. Solenomerite about as long as tibiotarsus, simply acuminate at end. . . . . *E. gracilis*

9(8) Head much wider than collum. Solenomerite distinctly longer than tibiotarsus, unciform at end. . . . . *E. postfemoralis*

10(7) Suture dividing pro- and metazona virtually smooth. Gonopod tibiotarsus neither folded nor complex in outline.

11(12) Size lesser: width 1.25 mm. Sternal lamina between ♂ coxae 4 without notch (Fig. 28). Gonopod femorite without processes, tibiotarsus especially strongly reduced, retained only as a low lobe (Figs 29-30). . . . *E. lobatus*

12(11) Size bigger: width 1.6 mm. Sternal lamina between ♂ coxae 4 notched apically (Fig. 32). Gonopod femorite with a distolateral tooth, tibiotarsus long and spiniform (Figs 33-36). . . . . *E. lateridens*

Borneochiropus gen. n.

Type-species: *Borneochiropus spinitergus* sp. n.

Medium-sized Antichiropodini with very modestly developed paraterga. Adenostyles absent. Sternal lamina between ♂ coxae 4 present.

Gonopods remarkable by a medium-sized coxite, a hypertrophied prefemur, a shortened and definitely tortiled femorite, and a very long and ribbon-shaped solenomerite, without trace of a solenophore, but with an outgrowth near base of solenomerite. Seminal groove running mostly laterally before reaching solenomerite.

Remarks: The tribe Antichiropodini has hitherto been considered as restricted to Australia and Tasmania, with only a single possible member encountered in New Guinea (JEEKEL 1968, 1979b). Therefore, the discovery of a representative on Borneo is highly interesting and important zoogeographically (see below).

Within the tribe, *Borneochiropus* seems quite disjunct. Indeed, the absence of adenostyles is almost unique, this character being shared only with the monobasic genus *Mjoebergodesmus* Verhoeff, 1924, from Australia. However, the most striking deviations lie in gonopod structure. What has no parallel not only among Antichiropodini, but perhaps amongst all Paradoxosomatidae but *Euphyodesmus* is the prefemoral part of *Borneochiropus* which is hypertrophied, and the femorite is relatively strongly reduced and unusually strongly shifted dorsad in relation to the prefemur.

The relatively long solenomerite, presence of only a single medio-distofemoral process at the base of the solenomerite, the seminal groove running first along a torsate femorite and then between the distofemoral process and the base of the solenomerite rather strongly resemble those observed in *Haplochiropus* Attems, 1944. Originally, it was proposed as a subgenus of the Southwest Australian genus *Antichiropus* Attems, 1911, for a single species, *A. pustulosus* Attems, 1944, from New Guinea, but later its tribal position was questioned by Jeekel (1968). However, in view of the existence of a number of true antichiropodines on Borneo, there seems to be no reason to further suspect that Attems (1944) could have mistaken an antichiropodine for an eustrongylosomatine. In other words, *Haplochiropus* is promoted herewith to full generic status, being to some extent intermediate between Australian Antichiropodini and *Borneochiropus* not only morphologically, but also geographically.

Yet *Borneochiropus* displays the most clear-cut relationships with *Euphyodesmus*, thus corroborating with zoogeographical evidence as well. This largely concerns the shared strongly reduced and spiniform paraterga, the strongly hypertrophied gonoprefemorite and the thick solenomerite very often devoid of any support/trace of a solenophore. However, the course of the seminal groove in *Borneochiropus* is singular in passing onto the solenomerite not on the ventral, as is the case in *Euphyodesmus*, but on the dorsal side of the distalmost part of the gonofemorite. This certainly makes both stand as "good" genera. In other words, *Euphyodesmus* and *Borneochiropus* must be regarded as especially closely related genera of the tribe Antichiropodini.

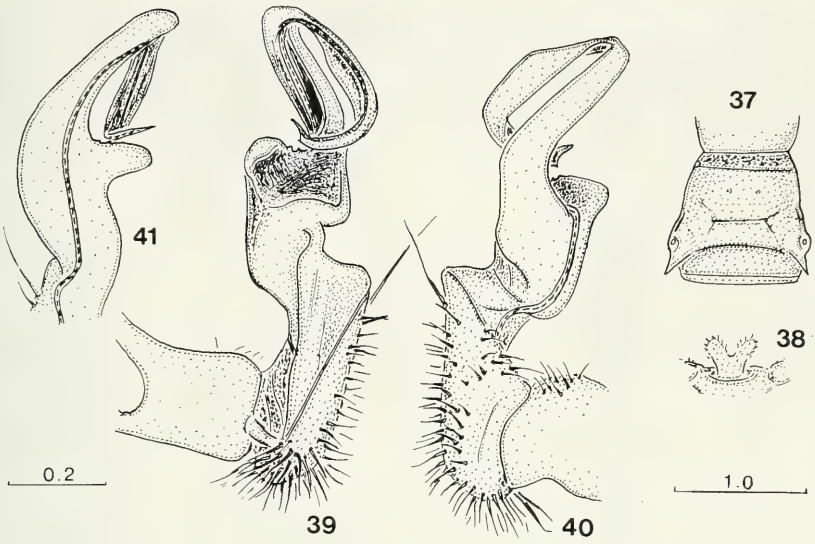
Borneochiropus spinitergus sp. n. (Figs 37-41)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sabah, Sandakan Residency, Sepilok, forest near pond, degraded lowland rain forest, beaten from vegetation, 26.1V.1982 (8240); leg. D. Burckhardt. – Paratypes: 1 ♂, 1 ♀ (MHNG), same locality, together with holotype. – 1 ♀ juv. (19 segm.) (MHNG), same locality, 26.IV.1982 (8239); leg. D. Burckhardt.

Description

Length of adults ca. 19-20 mm, width of midbody pro- and metazona 0.8 and 1.0–1.1 (♂♂), and 1.0 and 1.2 mm (♀), respectively. Coloration of adults uniform pale yellowish-brown to castaneous-brown, that of juvenile entirely pallid; in adults only paraterga, distal half of antennomere 6, proximal half of antennomere 7, tip of antenna, coxae, prefemora, and most of femora whitish.

Head considerably broader than collum and even midbody somites, postcollar constriction rather evident due to narrowest somites 3–4. Body strongly moniliform, parallel-sided on somites 5–17, onward gently and quite regularly tapering. Antennae very long, slender, in situ reaching beyond somite 5. Paraterga very modestly developed, poorly cariniform on collum and somites 2–4, onward mostly spiniform, somewhat better developed, spike-like, directed largely more dorsally than caudally, almost reaching to rear tergal contour on pore-bearing somites, gradually declining



FIGS 37-41

Borneochiropus spinitergus gen. n., sp. n., ♂ paratype: 37 – somite 10, dorsal view; 38 – sternal lamina between ♂ coxae 4, ventrocaudal view; 39-41 – left gonopod, mesal, lateral, and ventral views, resp. – Scales in mm.

almost to naught on somites 16–19. Paraterga generally set very high, on pore-bearing somites largely above dorsum and almost devoid of rim laterally (Fig. 37), on poreless ones invariably below dorsum, rather strongly rimmed laterally and well removed from rear tergal contour. Surface poorly shining, entirely smooth and very delicately shagreened. Somites strongly constricted, suture dividing pro- and metazona quite deep, somewhat more roughly shagreened but not striate. Transverse metatergal sulcus starting already from collum (♂) or somite 5 (♀), very modestly deep, thin and lineiform, almost wanting on somite 18, totally missing on somite 19. Tergal setae medium-sized, a few on collum and 1+1 on anterior half of somites 2–3, onward obliterated. Pleurosternal keels vestigial and present only on somite 2. Epiproct very short, weakly flattened dorsoventrally, narrowly truncate at tip. Subanal scale broadly and roundly subtrapeziform, usual.

Lamina between ♂ coxae 4 setose, distinctly bifid, higher than coxa, directed ventrad and slightly forward (Fig. 38). Sterna generally more shining, sparsely setose, without modifications. Legs extremely long, several times as long as body diameter, slender, in ♀ a little shorter, ♂ tarsal brushes only on pairs 1–2, onward setation thinning out together with leg elongation toward telson, without adenostyles.

Gonopods (Figs 39–41) very particular. Coxite moderately long, distoventrally modestly setose. Prefemur unusually strongly developed, setose as usual. Femorite

shortened, with evidence of torsion, strongly shifted dorsad and knee-shaped near middle, with a curved digitiform outgrowth (vestigial tibiotarsus?) near border between femorite and solenomerite. No trace of tibiotarsus. Solenomerite very long, somewhat coiled, rather ribbon-shaped, apically with a spike terminating seminal groove. Latter running mostly laterally before getting onto solenomerite.

Orangutana gen. n.

Type-species: *Orangutana setosa* sp. n.

Relatively small Orthomorphini with very modestly developed paraterga. Adenostyles absent. Sternal lamina present only between ♂ coxae 4.

Gonopods remarkable by the following combination: coxite long; femorite very long and slender, lacking a sulcus demarcating a postfemoral part; tibiotarsus (= solenophore) hypertrophied due to both lamina lateralis and a distally strongly notched lamina medialis, both laminae sheathing most of a relatively short and flagelliform solenomerite; free solenomerite beginning considerably proximally of, not about level to, sulcus demarcating tibiotarsus. Seminal groove entirely mesal.

Remarks: In the entire Sunda area, the chiefly Oriental tribe Orthomorphini has hitherto been known to be represented by the genera *Orthomorpha* Bollman, 1893 (Malay Peninsula, Java as well as Farther India, Bali and Lombok), *Gigantomorpha* Jeekel, 1963 (Borneo, Sulawesi, Bali), *Dajakina* Jeekel, 1963 (Borneo, Sumatra), *Nesorthomorpha* Jeekel, 1980 (Java), *Diglossosternum* Jeekel, 1980 (Java), and *Luzonomorpha* Hoffman, 1973 (Philippines). Of these, only *Orthomorpha* displays a gonopod tibiotarsus simple and virtually undivided at tip, so *Orangutana* appears to be more closely related in this respect to the remaining set. No gonopostfemoral sulcus is marked only in *Dajakina* and *Diglossosternum*, so *Orangutana* approaches here both of them. However, the distinctly hypertrophied gonopod solenophore and the beginning of a free solenomerite considerably more proximally of the demarcation sulcus between the femorite and tibiotarsus seem unique and make *Orangutana* easily distinguished from all other known Orthomorphini (see also review: Golovatch 1994a).

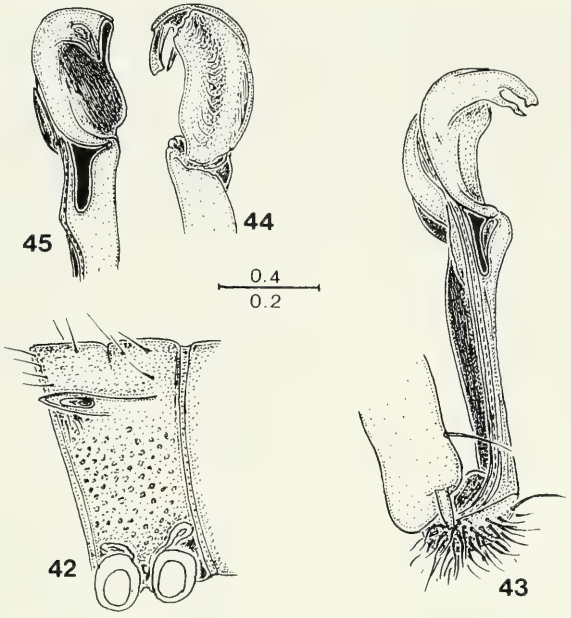
Orangutana setosa sp. n. (Figs 42–45)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sabah: Sandakan Residency, Sepilok, forest near pond, leaf litter in degraded lowland rain forest (extraction with Berlese-Tullgren funnel), 10.V.1982 (Sab-82/41); leg. B. Hauser. – Paratypes: 1 ♂, 1 ♀ juv. (19 segm.) (MHNG), same locality, together with holotype. – 1 ♂, 1 ♀ juv. (19 segm.) (ZMUM), same locality, sifted leaf litter and rotten wood, Winkler-Moczarski extraction, 23.IV.1982 (Sab-82/7); leg. B. Hauser.

Etymology: The generic and specific epithets refer to the cohabitation with the famous ape Orang-Utan and to the densely setose head and metaterga, respectively.

Description

Length of adults ca. 11–12 mm, width of midbody pro- and metazona 0.95 and 1.0 mm, respectively. Coloration of adults uniform pale yellowish-brownish to pale



FIGS 42-45

Orangutana setosa gen. n., sp. n., ♂ paratype: 42 – somite 10, lateral view; 43 – left gonopod, mesal view; 44-45 – gonopod tip, sublateral and subventral views, resp. – Scales in mm.

brown, juvenile entirely pallid; in adults tip of antenna, legs and ventrum whitish-yellow.

Head broadest, a bit broader than midbody somites; collum and somites 2-4 subequal in width, narrowest, but postcollar constriction poorly developed. Body parallel-sided on somites 5-18, onward tapering mostly on telson. Head very densely setose. Antennae rather short, slightly clavate, in situ reaching only beyond somite 2. Paraterga poorly developed, as a thin lappet on collum, always spiniform on subsequent somites, somewhat thicker on pore-bearing somites, set rather low, about 1/3–1/4 midbody height (Fig. 42), always within rear contour on poreless somites, (almost) within contour even on pore-bearing somites in front of somite 12 (Fig. 42) increasingly strongly surpassing rear tergal contour and beak-shaped until somite 15, onward gradually reduced. Surface of prozona dull, very delicately shagreened; sterna shining; metaterga shining dorsally, microgranulate only below paraterga, faintly rugulose in front of metatergal sulcus, more strongly behind it. Somites relatively poorly constricted, suture dividing pro- and metazona rather shallow, poorly striate longitudinally. Transverse metatergal sulcus starting from somite 5, shallow, not very thin, lineiform, almost reaching to base of paraterga, missing on somite 19. Traces of

an axial line on postsulcus parts of metaterga. Tergal setae rather long, very dense on collum, onward considerably less dense (also many broken off), but little by little growing more dense caudally, somite 19 already beset with setae almost like head; setation pattern usually as 1-2 irregular rows in front of and 2-3 rows behind sulcus, caudalmost row being especially dense and complete (Fig. 42). Pleurosternal keels entirely missing. Epiproct medium-sized, a little flattened dorsoventrally, with preapical incisions well removed from a narrowly rounded tip. Subanal scale trapeziform, with a usual paramedian pair of indistinct setiferous knobs near rear margin.

Lamina between ♂ coxae 4 setose, broad, about as high as coxa, directed ventrad and slightly forward, distinctly bimodal. Sterna sparsely setose, with vestigial rounded knobs near coxae from ♂ somite 8 onward. Legs relatively short, slightly longer and incrassate in ♂♂ as compared to juvenile, with neither adenostyles nor tarsal brushes.

Gonopods (Figs 43-45) very high, generally slender, only terminally falcate caudally. Femorite with neither traces of torsion nor postfemoral demarcation. Solenophore very strongly developed, about 1/3 femorite in length, set off from femorite by a distinct demarcation sulcus, curved caudad, sheathing a relatively moderately long solenomerite almost all along its length; both lamina medialis and lamina lateralis equally well-developed, former terminally deeply notched. Seminal groove entirely mesal, free solenomerite starting well before demarcation site between femorite and solenophore.

Dajakina longipes sp. n. (Figs 46-53)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sabah: Sandakan Residency, Sepilok, "Kabili-Sepilok Forest Reserve", forest near "Orang-Utan Rehabilitation Station", 30 m, lowland rain forest, 22.IV.1982 (Sab-82/2); leg. B. Hauser. – Paratypes: 1 ♂ (MHNG), 1 ♂ (ZMUM), same locality, together with holotype. – 2 ♂♂ (MHNG), same locality, beaten from vegetation, 12.III.1983 (Pal-83/7); leg. C. Lienhard.

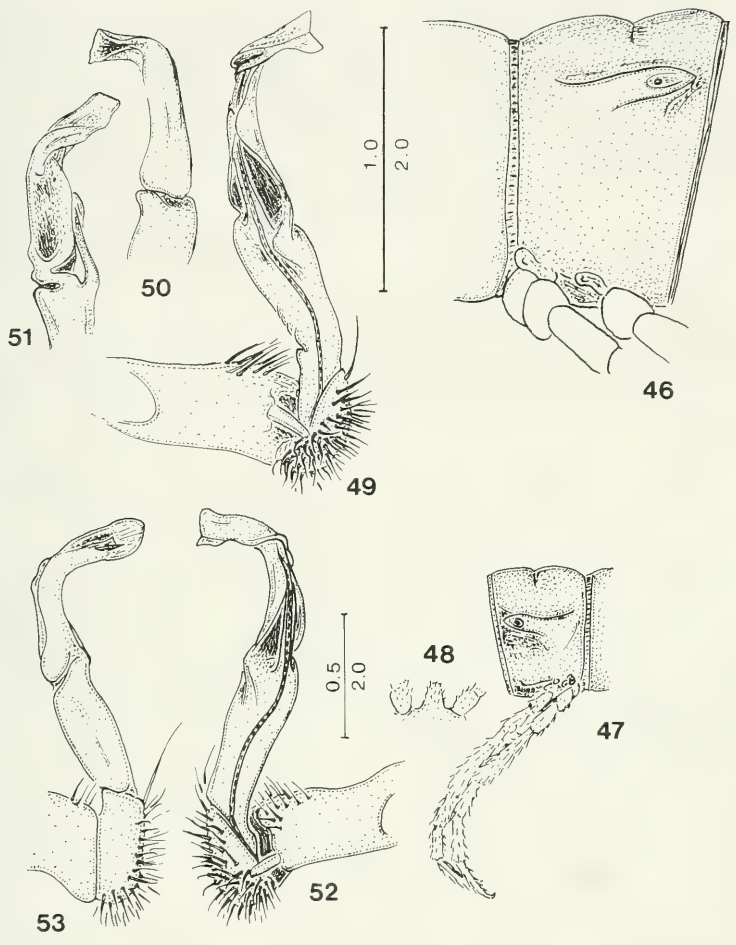
Etymology: The species epithet refers to the extremely long legs.

Diagnosis: Differs from congeners by the presence of a sternal lamina between the ♂ coxae 4 combined with the absence of gonofemoral outgrowths, as well as by the shape of the gonopod tibiotarsus.

Description

Length ca. 29–32 mm, width of midbody pro- and metazona 1.9-2.0 and 2 5-2.6 mm, respectively. Holotype ca. 30 mm long, 2.0 and 2.5 mm wide on midbody pro- and metazona, respectively. Coloration blackish-brown dorsally to somewhat below paraterga, rather sharply contrasting with whitish-yellow ventrum, legs, and lower halves of sides. Antennae brown to dark brown, basal half of antennomere 7 invariably, tip of antennomere 6 sometimes, very dark brown to blackish. Clypeus and labrum whitish to pale brown.

Head, collum, somites 3-4 subequal in width, each a bit broader than narrowest somite 2, but a little more narrow than somite 5. Body modestly moniliform, parallel-sided on somites 5-17, onward very gently and regularly tapering. Antennae very



FIGS 46-53

Dajakina longipes sp. n., ♂♂ paratypes: 46-47 – somite 10, lateral view; 48 – sternal lamina between ♂ coxae 4, caudal view; 49-53 – gonopods, mesal, lateral, ventral, mesal, and lateral views, resp. – Scales in mm.

long, slender, very slightly clavate, in situ reaching beyond somite 4. Paraterga very modestly developed, especially thin on collum and somite 2, considerably thicker on pore-bearing somites, set rather low, 1/2-1/3 midbody height (Figs 46-47), always delimited from above and, especially on poreless somites, from below, caudally largely poorly dentiform, a little surpassing rear tergal contour only on somites 2, 18, and 19. Surface poorly shining, generally smooth, rugulose only behind metatergal sulcus. Somites rather strongly constricted, suture dividing pro- and metazona quite

deep and strongly striate longitudinally. Transverse metatergal sulcus starting from somite 5, moderately deep, thin and lineiform, missing on somite 19. Tergal setae short, a few on collum and at least 1+1 on anterior half of somite 2. Pleurosternal keels present as rather strong, caudally pointed teeth surpassing rear contour on somites 2-4, smaller denticles almost within contour on somites 5-7, scarcely traceable on somite 8, onward virtually missing. Epiproct medium-sized, somewhat flattened dorsoventrally, with preapical incisions extremely close to a roundly truncate tip, in dorsal view almost parallel-sided throughout, in lateral view almost straight. Subanal scale semi-circular, with a usual paramedian pair of indistinct setiferous knobs near rear margin.

Lamina between ♂ coxae 4 setose, linguiform, about as high as coxa, directed ventrad and slightly forward (Fig. 48). Sterna generally shining, scarcely setose, without modifications. Legs very long (Fig. 47), slender, with neither adenostyles nor tarsal brushes; very moderate setation thinning out together with leg elongation toward telson

Gonopods (Figs 49-53) very slender. Femorite often with traces of dorsal wrinkles parabasally, without postfemoral demarcation. Solenophore about as long and slender as femorite, slightly curved caudad, sheathing a moderately long solenomerite almost all along its length. Tip of tibiotarsus slightly varying in shape.

Remarks: The genus *Dajakina* Jeekel, 1963, has hitherto been known to comprise four species: *D. oculata* Jeekel, 1963 (the type-species), *D. rotundata* (Attems, 1931), *D. hastata* Jeekel, 1983b, all from Borneo, and *D. inermis* (Silvestri, 1895), from Sumatra (JEEKEL 1963, 1979a, 1983b). The new species is interesting in having the gonofemorite often slightly rugose in the area supporting a fringe in *D. oculata* and a strong process in *D. hastata*.

All currently known *Dajakina* species can be separated using the following key:

1(4) Paraterga of pore-bearing somites abbreviated, eye-shaped in lateral view.

2(3) Size lesser: width 2.4 mm (♂). Antennomere 6 unmodified, subcylindrical, without inflation. Pleural areas unmodified. Sternal lamina between ♂ coxae 4 present, conical. Gonopod femorite with a long, lanceolate, dorso-parabasal process. . . . . *D. hastata*

3(2) Size bigger: width 4.0 mm (♂). Antennomere 6 characteristically inflated. Pleural areas of ♂ somites 8-18 each with a caudal emargination. No sternal process on ♂ somite 5. Gonopod femorite with only a spike instead of parabasal process. . . . . *D. oculata*

4(1) Paraterga of pore-bearing somites as usual ridges, demarcated by a furrow at least from above.

5(6) Paratergal caudal corner strongly spiniform on several caudalmost somites. Transverse metatergal sulcus starting from somite 2. Sumatra. *D. inermis*

6(5) Paratergal caudal corner at most poorly dentiform. Transverse metatergal sulcus starting from somite 5. Borneo.

7(8) Paraterga rounded caudally, pore-bearing ones demarcated by a furrow only from above. No sternal lamina between ♂ coxae 4. Tarsal brushes on a few anterior legpairs of ♂ ..... *D. rotundata*

8(7) Paraterga poorly dentiform caudally; pore-bearing ones demarcated by a furrow both from above and below (Figs 46-47). Sternal lamina between ♂ coxae 4 present (Fig. 48). Tarsal brushes wanting. .... *D. longipes*

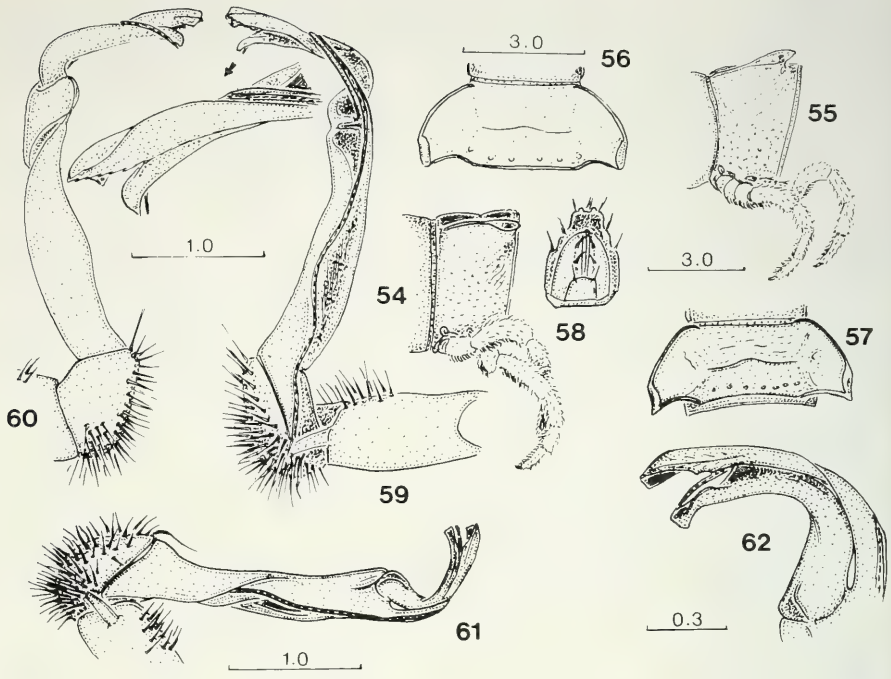
Gigantomorpha immanis Jeekel, 1963 (Figs 54-62)

Material: 2 ♂♂ (MHNG), East Malaysia, Borneo, Sabah, Sandakan Residency, Sepilok, "Kabili-Sepilok Forest Reserve", forest near "Orang-Utan Rehabilitation Station", lowland rain forest, 24.III.1983 (Pal-83/50); leg.B. Hauser. – 1 ♀ (MHNG), same locality, 3.V.1982 (Sab-82/26). – 1 ♀ (MHNG), Sepilok, forest near pond, degraded lowland rain forest, 4.V.1982 (Sab-82/28). – 2 ♂♂ (MHNG), 1 ♂ (ZMUM), Sepilok, "Kabili-Sepilok Forest Reserve", path toward mangrove, before "Ridge", lowland rain forest, 6.V.1982 (Sab-82/30). – 1 ♂ (MHNG), Interior Residency, Kimanis road, 8.5 mi from Keningau, path from "Checkpoint" to above village "Temperate Vegetation Project", 950–1150 m, 13.V.1982 (Sab-82/47). – 1 ♂ (MHNG), same locality, 8.5 mi from Keningau, Checkpoint, near barracks, under stones, 950 m, 14.V.1982 (Sab-82/52); all leg. B. Hauser. – 1 ♂ (broken into several pieces) (MHNG), Borneo, Brunei, Temburong Distr., "Peradayan Forest Reserve" (= "Bukit Patoi"), 14.5 km from Bangar (= 2.5 km from Labu), primary mixed dipterocarp forest, 10-300 m, 24.XI.1988 (Bru-88/39); leg. C. Lienhard.

Remarks: The genus *Gigantomorpha* Jeekel, 1963, has hitherto been known to comprise nine species: *G. immanis* Jeekel, 1963 (the type-species), *G. aterrima* Jeekel, 1963, *G. cornalata* Jeekel, 1963, *G. fasciata* (Attems, 1898), *G. pallida* Jeekel, 1963, *G. spinescens* Jeekel, 1963, *G. transmontana* Jeekel, 1983b, *G. trichopleura* Jeekel, 1963, all from Borneo, and *G. socialis* (Carl, 1912), from Sulawesi (Jeekel 1963, 1983b). A tenth congener, *G. mutilata* sp. n., has just been encountered on Bali (see below). Of them, *G. immanis* seems to be quite widespread, being encountered at least in Northwest and East Borneo. The above material extends considerably the known range of this species northwesterly.

Already Jeekel (1963) in his original description of *G. immanis* noted its pronounced variability concerning size, shape of the paraterga and epiproct, leg pubescence, etc. Based on such variations, he even referred some specimens to *G. immanis* with qualifications, writing that "a much more abundant material is needed to decide whether these characters are of really subspecific value or just represent population varieties" (op. cit., p. 247).

The above new evidence allows to significantly refine the variation range of *G. immanis*. The only Brunei ♂ is 3.95 and 6.8 mm in width on midbody pro- and metazona, respectively, while the Sabah specimens at hand are only 48–55 mm in length, width of midbody pro- and metazona 3.9-4.2 and 6.7-7.0 (♂♂), and 4.2-4.8 and 6.8-7.0 mm (♀♀), respectively, this being on the average somewhat less than reported by Jeekel (1963). The ♂ legs are ventrally densely setose, especially due to prefemora, femora and tarsi, but the degree of gradual thinning out of setation toward the caudal body end varies, sometimes concerning not only somites 15–18, but even 13–18. Sometimes the background coloration can be quite pale brown, but the pattern



FIGS 54-62

Gigantomorpha immanis Jeekel, 1963, ♂♂ from near Keningau Checkpoint (54, 56, 58-60) and Kabili-Sepilok (55, 57, 61-62): 54-55 – somite 10, lateral view; 56-57 – somite 10, dorsal view; 58 – telson, ventral view; 59-61 – gonopods, mesal, lateral, and mesal views, resp.; 62 – distal part of gonopod, mesal view. – Scales in mm.

mostly persists, discarding the poor development to virtual absence of a pale prosomital spot in the Brunei and some Sabah samples. What seems even more important is that not only the outline of some paraterga somewhat varies in dorsal view (cp. Figs 56 & 57), but the degree of elevation over the dorsal level ranges from somewhat below (Fig. 54) to a little above it (Fig. 55) even on midbody somites of Sabah specimens alone. The paraterga start surpassing the rear tergal contour on the somites 11 or 12-19, sometimes being very narrowly rounded, more often pointed throughout. The tubercles near the caudal margin of metaterga are often not very flat, as small round knobs (cp. Figs 56-57), the pattern of tuberculation usually being quite irregular, 3-4+3-4, on more caudal metaterga up to 5+5. The metatergal sulcus is always lineiform, mostly quite shallow, only more seldom relatively deep. The terminal knobs on the epiproct can be somewhat bigger or smaller (Fig. 58). Finally, even the gonopods vary in outline a bit (Figs 59-62), although the tip is very characteristic.

WANG & TANG (1965) reported *Orthomorpha hydrobiologica* Atems, 1930, from Singapore. A bit later WANG (1967b) recorded there also *Gigantomorpha tenuipes* (Atems), a Javan species long known to actually belong to the genus *Orthomorpha* (e.g., JEEKEL 1963). Why the latter species was transferred in *Gigantomorpha* by Wang, remains totally obscure, the most probable reason why JEEKEL (1968) ignored it altogether. What seems more important is that an endemic Singapore *Orthomorpha* has since emerged. This is *O. murphyi* Hoffman, 1973, which might well correspond to Wang's record(s) above.

In addition, WANG (1967a) reported *Gigantomorpha fasciata* (Attems) from Brunei and simultaneously transferred three Philippine species of Paradoxosomatidae to *Gigantomorpha*, again giving no explanation to the latter reallocations. It seems noteworthy that all those three forms from the Philippines have since been placed in the orthomorphine genus *Luzonomorpha* Hoffman, 1973. Such obvious mistakes of WANG's, some more of which will be mentioned further below, coupled with a very poor quality of his descriptions question most if not all his diplopod taxonomy (see also below). Concerning WANG's (1967a) record of a *Gigantomorpha* in Brunei, I believe he could have actually dealt with *G. immanis*.

Gigantomorpha mutilata sp. n. (Figs 63-70)

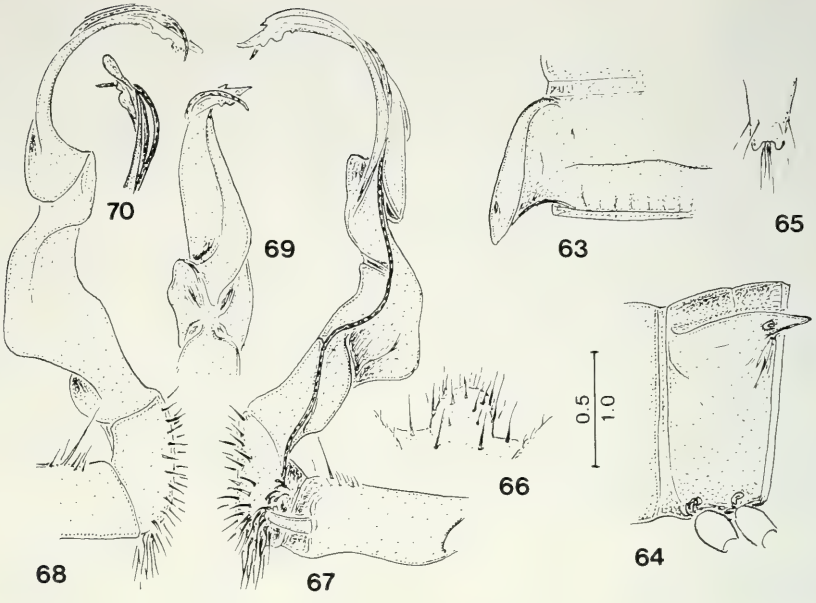
Material: HOLOTYPE ♂ (MHNG), Indonesia, Bali: Bedugul, slope above Lake Bartan, 1130–1180 m, beaten from vegetation, 29.XI.1987 (Sar-87/34); leg. C. Lienhard. – Paratypes: 1 ♀ (MHNG), same data, together with holotype. – 2 ♀♀ (MHNG), 1 ♀ (ZMUM), same locality, Botanical Gardens, forested part, 1230–1260 m, chiefly beaten from vegetation, 30.XI1.1987 (Sar-87/36); leg. C. Lienhard.

Diagnosis: Differs from congeners largely by the least body size and conspicuous gonopod structure.

DESCRIPTION

Body length ca. 20–22 mm, midbody pro- and metazonites 2.0 and 3.0 (♂), 2.6 and 3.2 or 2.0 and 2.8–2.9 mm (♀♀), respectively. Coloration generally dark rusty (purplish) brown to chocolate brown; paraterga, lower parts of sides, epiproct and legs brown to pale brown; sterna yellow-brown, tip of antenna whitish.

Head subequal in width to collum and a bit narrower than somite 2, latter a bit narrower than subequally wide somites 3-4. Body parallel-sided on somites 5-16, onward gently and gradually tapering. Antennae not very long, rather slender, in situ extending only beyond somite 3 (♂) or 2 to midway of 3rd (♀) dorsally. Paraterga very strongly developed (Fig. 63), set high (at about 1/4 midbody height), yet not reaching to level of dorsum (Fig. 64), in dorsal view broadly rimmed, in lateral view almost equally narrow on pore-bearing and poreless somites, caudally mostly beak-shaped, pointed and surpassing rear tergal contour (especially well so in ♂), narrowly rounded only on collum (♂) or collum and somite 2 (♀), considerably less strongly protruding only on somite 19. Ozopores big, lateral, inside a shallow groove. Surface poorly shining, only sterna shining, prozonites delicately shagreened, metaterga



FIGS 63-70

Gigantomorpha mutilata sp. n., ♂ holotype: 63-64 – somite 10, lateral and dorsal views, resp.; 65 – epiproct, dorsal view; 66 – sternal lamina between ♂ coxae 4, caudal view; 67-68 – right gonopod, mesal and lateral views, resp.; 69-70 – distal part of right gonopod, ventral and subfrontal views, resp. – Scales in mm.

generally smooth, metazonites slightly rugulose only near base of paraterga and near caudal edge, often almost smooth, sometimes (♂) caudal edge with traces of incisions (Fig. 63); surface below paraterga slightly rugulose and delicately granulate, only collum with traces of an axial line. Both dorsal and lateral surfaces of metazonites micropiliferous, micropilosity being mostly fully or considerably obliterate. Somites only slightly constricted, suture dividing pro- and metazonites shallow, without striation. Transverse metatergal sulcus starting from somite 5, rather shallow, thin and lineiform, reaching to base of paraterga, missing on somite 19. Tergal setae medium-sized, mostly broken off, a few on collum, pattern 2+2 in a presulcus row. Pleurosternal carinae as little caudal teeth only on somites 2–4, onward wanting. Epiproct long, flattened dorsoventrally, in lateral view almost straight, from above conical, preapical incisions little, well removed from tip, apical papillae big (Fig. 65). Subanal scale high and trapeziform, with a pair of well-developed, setiferous, paramedian knobs at caudal margin.

Sterna densely setose, without modifications, between ♂ coxae 4 with a moderately big, roundly subtrapeziform, setose lamina directed mainly ventrally (Fig. 66). Legs not very long, slender, slightly longer and more strongly incrassate in ♂,

without adenostyles, femora normal, tarsal brushes present until ♂ legs of somite 11, onward setation thinning out yet very dense, especially so ventrally and in ♂.

Gonopods (Figs 67-70) high and rather complex. Coxite rather short, slender, cylindrical, distoventrally setose. Prefemoral part medium-sized, densely setose as usual. Femorite rather long, folded laterally and, especially, mesally; distofemoral portion demarcated by a well-developed postfemoral sulcus laterally and ventrally; apical part with a ventral lobule with solenomerite starting at its base. Both tibiotarsus and solenomerite long and slender, slightly curved, subequal in length. Apical part of tibiotarsus (= solenophore) without distinct branching, with a few minute lobules and a little ventro-preapical spinule.

Remarks: As noted before, the bulk of *Gigantomorpha* constituents is Bornean (JEEKEL 1963, 1983b). Interestingly, the above new species extends the generic range to the Lesser Sunda. The relatively small size and a little disjunct gonopod conformation of *G. mutilata*, especially the particularly strongly folded femorite, parallel its peripheral distribution, yet failing to broaden the concept of the genus concerned.

A key to Bornean *Gigantomorpha* already exists (JEEKEL 1963) and still holds valid, except that *G. fasciata* sensu JEEKEL (1963) has since been shown to represent an independent species, *G. transmontana* (JEEKEL 1983b). Superficially, another key based on such limited materials as above might seem superfluous, yet just below I provide one, for it allows to incorporate all currently known congeners and to refine some diagnostic features:

1(2) Lesser: width 2.8–3.2 mm (♂, ♀). Paraterga especially strongly bordered (Fig. 63). Sternites usual, without cones near coxae. Gonopods as in Figs 67-70. Bali. . . . . *G. mutilata*

2(1) Bigger: width of adults at least 5 mm. Paraterga less strongly bordered. Sternites modified, usually with a cone near coxa. Gonopods different. Borneo or Sulawesi.

3(6) Lateral sides of collum rounded, caudally not angular. Paraterga 2 turned somewhat ventrad, distinctly below level of paraterga 3. Even ♂ femora straight.

4(5) Lesser: width 5.0–5.4 mm (♂, ♀). A pattern of 4(5)+4(5) very small tubercles near caudal margin of metaterga. Paraterga set relatively low (at about midheight on ♂ somite 4), below them almost all somites with an irregular row of setae along caudal margin. Pleurosternal keels extending back to somite 17. . . . . *G. trichopleura*

5(4) Bigger: width 6.3-8.0 mm (♂, ♀). Usually 3+3 bigger tubercles near caudal margin of metaterga. Paraterga set distinctly higher (at about 1/3 height on ♂ somite 4), without setae below them. Pleurosternal keels extending back only to somite 14 or 15. . . . . *G. spinescens*

6(3) Lateral sides of collum angular caudally. Paraterga 2 turned somewhat dorsad, nearly level to paraterga 3. ♂ femora distinctly arched.

5(8) Coloration in ethanol very dark brown to blackish, with paraterga and a rather narrow continuous middorsal band pale brownish. Gonopod femorite rather strongly constricted about halfway.

6(7) Pleurosternal keels traceable back to somite 14 or 15. ♂ legs more strongly incrassate, all podomeres very densely setose ventrally, forming real brushes of very dense and short setae at least on femora, the brushes gradually thinning out caudally and disappearing only in last pairs. . . . . *G. fasciata*

7(6) Pleurosternal keels traceable back to somite 10 only, onward missing. ♂ legs less strongly incrassate, ventral setation on podomeres forming virtually no true brushes. . . . . *G. transmontana*

8(5) Somites without a continuous middorsal pale band. Gonopod femorite devoid of a notable midway constriction.

9(10) Coloration in ethanol uniform blackish, only paraterga near caudal corner brown. ♂ proximal podomeres beset with short curved setae, femora less strongly arched. . . . . *G. aterrima*

10(9) Coloration of dorsum in ethanol either somewhat paler, sometimes with a pale central spot on prosomites, or dark with contrastingly yellow parts, then at least paratergal caudal corners always yellowish. ♂ legs beset with long erect setae, femora more strongly arched.

11(14) Pleurosternal keels traceable until somite 16 or 17.

12(13) Coloration of dorsum rather uniform pale brownish-gray. Paraterga more or less distinctly projecting caudally beyond rear tergal contour from somite 11 or 12 onward. East Borneo. . . . . *G. pallida*

13(12) Coloration black-brown with caudal corners of paraterga yellow. Paraterga extending caudally beyond rear tergal contour only from somite 15 onward. South Sulawesi. . . . . *G. socialis*

14(11) Pleurosternal keels traceable back at best to somite 14 or 15.

15(16) Paraterga largely strongly elevated above dorsum. Pleurosternal keels traceable back to somite 14 or 15. ♂ legs more slender, proximal podomeres without ventral brushes of setae. . . . . *G cornalata*

16(15) Paraterga more or less level to dorsum (Figs 54-55). Pleurosternal keels traceable back only to somite 9 or 10. ♂ legs more strongly incrassate, with ventral brushes on all podomeres (Figs 54-55). . . . *G. immanis*

Kalimantanina crucifera sp. n. (Figs 71–75)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sabah, Sandakan Residency, Sepilok, forest near pond, degraded lowland rain forest, beaten from vegetation, 8.V.1982 (82150), leg. D. Burckhardt. – Paratype: ♀ (MHNG), same locality, 26.IV.1982 (8240); leg. D. Burckhardt.

Etymology: The species epithet refers to the peculiar colour pattern on each somite resembling a cross.

Diagnosis: Differs from congeners by the cruciform colour pattern combined with the particularly strongly reduced tooth at base of the solenomerite.

DESCRIPTION

Length ca. 26 (♂) and 31 mm (♀), width 2.0 (♂) and 2.6 mm (♀). Background coloration pale whitish with a peculiar pattern on dorsum consisting of a dark brown, rather narrow, axial stripe crossed on each metatergum by a similar transverse band outlining sulcus, crossing areas and protergal line being often superimposed over a more or less big, pale brown spot; a brown, almost continuous, lateral stripe on each side level to paraterga and covering caudal half of paraterga and mostly extending onto prozona. Antennae pallid, only distally darker, especially due to very dark brown distal half of antennomere 6 and basal half of antennomere 7. Head pale brown eventually throughout. Collum margined narrowly brown.

Head a bit broader than subequal collum and somite 2, but a bit narrower than somites 5-18. Postcollar constriction evident on subequally narrowest somites 3-4. Body distinctly moniliform, rapidly tapering caudad on somites 19-20. Antennae long, slightly clavate, in situ reaching to end of somite 4 in ♂, missing (right) or too short (left) in ♀ (perhaps regenerated). Paraterga modestly developed, somewhat thicker on pore-bearing somites, set rather low, mostly at 1/2-1/3 midbody height, demarcated by a sulcus from above and below, caudally invariably gently rounded and lying mostly within rear tergal contour (Fig. 71), only on somite 19 just a bit surpassing it. Ozopores lying near caudal corner of paraterga in an indistinct groove (Fig. 71). Surface shining, generally smooth, slightly rugulose only below paraterga and behind sulcus. Somites strongly constricted, suture dividing pro- and metazona deep, strongly striate longitudinally. Transverse metatergal sulcus starting from somite 5, moderately deep, thin and lineiform, missing on somite 19. Tergal setae minute, a few on collum, pattern of 2+2 setae on somite 2, of 1+1 at least on somites 3 and 19, mostly missing. Pleurosternal keels present only until somite 7, onward totally missing, better developed in ♂, displayed as small spines either surpassing rear contour (♂) or not (♀). Epiproct long, distinctly flattened dorsoventrally, in lateral view almost straight, from above coniform, rather narrowly truncated, with preapical incisions quite distinctly removed from tip. Subanal scale roundly subtriangular, with a pair of indistinct, setiferous, paramedian knobs at a rather narrow caudal margin.

Sterna scarcely setose, strongly shining, with a big, linguiform, setose lamina between ♂ coxae 4 (Fig. 72). Legs long, similarly slender in both sexes, rather sparsely setose ventrally, without adenostyles.

Gonopods (Figs 73-75) subfalcate, typical for the genus. Base of free solenomerite with a very little, simple, mesal tooth. Tip of tibiotarsus characteristically shaped.

Kalimantanina bruneica sp. n. (Figs 76–81)

Material: HOLOTYPE ♂ (MHNG), Borneo, Brunei, Belait Distr., "Andulau Forest Reserve", 3.5 km S of Sungaim Liang (ca. 39.5 km from Labi), mixed dipterocarp forest, "K-7" beaten from vegetation, 19.XI.1988 (Bru-88/22); leg. C. Lienhard. – Paratypes: 1 ♂ (MHNG), Belait Distr., near Sungai Mau, ca. 14 km along road from Sungai Liang to Labi (1.5 mi along secondary road toward Badas), ca. 50 m, beaten from vegetation, 16.XI.1988 (Bru-88/9). – 1 ♂ (ZMUM), Belait Distr., "Badas Forest Reserve", ca. 10 km along secondary road branching 32

km of Kuala Belait toward S, 10 m, "Kerangas" forest (= tropical heath forest) mostly of *Agathis dammara* (Lambert) L.G.Rich. (Araucariaceae), under bark, 23.XI.1988 (Bru-88/36); all leg. C. Lienhard.

Other material tentatively attributed to this species: 1 ♀ (MHNG), Borneo, Brunei, Tutong Distr., little market on road coming from Muara, 77 km from Kuala Belait, ca. 40 m, beaten from vegetation, 18.XI.1988 (Bru-88/17); leg. C. Lienhard.

Etymology: The species epithet refers to the terra typica.

Diagnosis: Differs from congeners by the generally pallid coloration combined with the peculiar shape both of the tooth at base of the solenomerite and the gonopod tibiotarsus.

Description

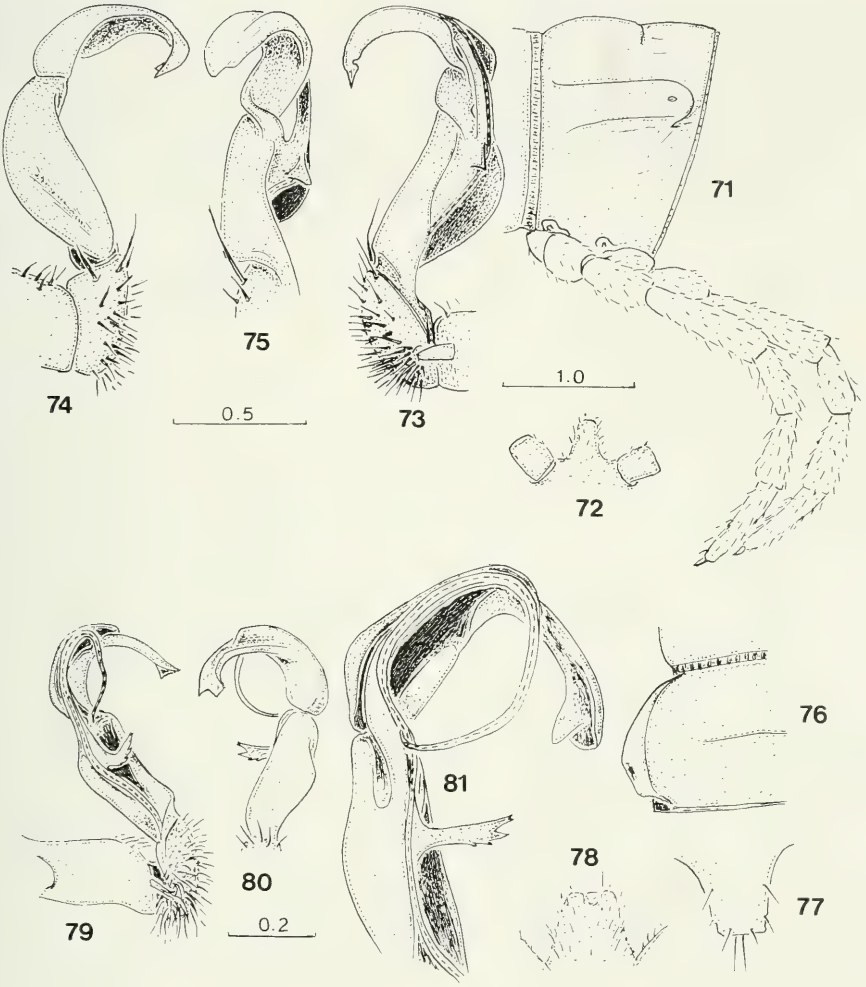
Length of ♂♂ ca. 25-26, width of midbody pro- and metazona 1.7-1.8 and 2.0-2.1 mm, respectively. Coloration entirely pallid to pale yellowish-brown, devoid of a pattern, only distal half of antennomere 6 and most of antennomere 7 sometimes dark brown to blackish.

Head a bit broader than collum, subequal to somites 2 and 4, a little broader than narrowest somite 3 but a bit narrower than somites 5-18, onward body rapidly tapering. Antennae relatively short, slightly clavate, in situ scarcely reaching to end of somite 3 in ♂. Paraterga modestly developed, much like in *K. crucifera*, somewhat thicker on pore-bearing somites, set rather low, largely at 1/2-1/3 midbody height, caudally invariably gently rounded and lying mostly within rear tergal contour (Fig. 76), only on somite 19 just a bit surpassing it and more strongly dentiform; on somite 2 anterior corner with a minute sharp denticle and caudal corner strongly rounded and somewhat surpassing rear tergal contour. Ozopores lateral, lying near caudal corner of paraterga in an indistinct groove (Fig. 76). Surface shining, generally smooth throughout, slightly microgranulate only below paraterga 2-4. Somites strongly constricted, suture dividing pro- and metazona deep, strongly ribbed longitudinally. Transverse metatergal sulcus starting from somite 5, deep, thin and lineiform, missing on somites 18-19. Tergal setae minute, mostly missing, a few on collum, pattern untraceable. Pleurosternal keels preserved only as poorly developed teeth lying within rear contour, present only on somites 2-4 and 6, virtually absent from somites 5, 7 and so on. Epiproct long, distinctly flattened dorsoventrally, in lateral view almost straight, from above coniform, rather broadly truncate, with preapical incisions very poorly developed and placed close to tip (Fig. 77). Subanal scale high, subtrapeziform, with a pair of indistinct, setiferous, paramedian knobs at a rather narrow caudal margin.

Sterna scarcely setose, strongly shining, with a big, trapeziform, setose lamina between ♂ coxae 4 (Fig. 78). Legs long, similarly slender in both sexes, rather sparsely setose ventrally, without adenostyles.

Gonopods (Figs 79-81) subfalcate, typical for the genus. Base of free solenomerite with a little, very slightly curved, serrate, mesal tooth. Tip of tibiotarsus characteristically shaped.

Remarks: The genus *Kalimantanina* Jeekel, 1963, has hitherto been known to comprise five species, all confined to Borneo: *K. ruficeps* Jekel, 1963 (the type-



FIGS 71-81

Kalimantanina crucifera sp. n., ♂ holotype (71-75), and *Kalimantanina bruneica* sp. n., ♂ holotype (76-81): 71 & 76 – somite 10, lateral and dorsal views, resp.; 72 & 78 – sternal lamina between ♂ coxae 4, caudal view; 73–75, 79-81 – gonopods, mesal, lateral, ventral, mesal, sublateral, and subdorsal views, resp.; 77 – epiproct, dorsal view; – Scales in mm: 0.35 (76-77), 0.25 (78-80), 0.12 (81).

species), *K. albonigra* Jeekel, 1963, *K. decolorata* Jeekel, 1963, *K. hirtitarsus* Jeekel, 1963, and *K. ocellata* Jeekel 1963 (JEEKEL 1963). Both *K. crucifera* and *K. bruneica* are quite typical congeners, failing to broaden the concept of the genus concerned.

All currently known *Kalimantanina* species can be separated using the following key:

1(6) Colour pattern present, distinct on body somites.

2(3) Body lesser: width 2.0 (♂) to 2.6 mm (♀). Only paraterga 19 as a small denticle projecting caudally beyond rear tergal contour. Tarsal brushes missing. Transverse metatergal sulcus wanting only on somite 19. Process at base of solenomerite particularly small, dentiform (Figs 73, 75). ..... *K. crucifera*

3(2) Body bigger, width closer to 3-3.5 mm (♂). Caudal denticles on paraterga 18-19 lying within rear tergal contour. Tarsal brushes present. Transverse metatergal sulcus wanting on somites 18-19. Gonofemoral process at base of solenomerite bigger.

4(5) White area dorsally of paraterga only half as wide as paraterga. Gonofemoral process lanceolate. ..... *K. ocellata*

5(4) White area dorsally of paraterga about as wide as paraterga. Gonofemoral process spiniform. ..... *K. albonigra*

6(1) Coloration more or less strongly uniform, pallid to very dark, sometimes only head and anal valves of a contrasting colour.

7(8) Body lesser: width 2.0-2.1 mm (♂). Tarsal brushes missing. Pleurosternal keels only on somites 2-4 and 6. Gonofemoral process little, serrate (Figs 79–81). ..... *K. bruneica*

8(7) Body bigger: width at least 2.5 mm (♂). Tarsal brushes present on most ♂ legs. Pleurosternal keels on somites 2-7, sometimes vestigial also on somite 8. Gonofemoral process bigger.

9(10) Background coloration almost entirely pallid. Sternal lamina between ♂ coxae 4 distinctly bilobed. Paraterga 18-19 caudally dentiform and slightly surpassing rear tergal contour. Gonofemoral process arising well proximally of base of solenomerite. ..... *K. decolorata*

10(9) Background coloration dark to very dark, blackish, with head and anal valves contrastingly reddish-brown. Sternal lamina between ♂ coxae 4 at most scarcely emarginate. Caudal corner of paraterga 18-19 lying within rear tergal contour. Gonofemoral process arising more distally, just at base of solenomerite.

11(12) Lesser: width 2.5-2.6 (♂) and 3.2-3.4 mm (♀). Tarsal brushes absent from ♂ legs of posterior body half. Gonofemoral process arising from solenomerite. ..... *K. ruficeps*

12(11) Bigger: width 3.1 mm (♂). Tarsal brushes absent only from two last ♂ legpairs. Gonofemoral process arising just proximally of base of solenomerite. ..... *K. hirtitarsus*

Opisthodolichopus scandens Hoffman, 1973 (Figs 82-85)

Material: 1 ♂, 2 ♀ (MHNG), Singapore: Bukit Timah Nature Reserve, from Summit Hut to Simpang Hut along North View Path, Jungle Fall Path and Fern Valley Contour Path, 90-140 m, beaten from vegetation, 17.XII.1987 (Sar-87/97); leg. C. Lienhard.

Remarks: The above strictly topotypical material fully corresponds to the nice original description (HOFFMAN 1973), as can be seen from the new illustrations (Figs 82-85). This species has hitherto been known only from Singapore and is believed to represent a true arboricole.

In addition to a new congener described just below, the genus *Opisthodolichopus* Verhoeff, 1941, embodies four acknowledged species: *O. javanicus* (Attems, 1903), from Java, *O. nigricornis* (Pocock, 1894) and *O. thienemanni* (Attems, 1930) (the type-species), both from Sumatra, as well as *O. scandens* Hoffman, 1973, from Singapore (JEEKEL 1968; HOFFMAN 1973). Therefore, below is the first record of an *Opisthodolichopus* species in Borneo. The new illustrations of *O. scandens* are provided here for comparative purposes.

Opisthodolichopus bifidus sp. n. (Figs 86-89)

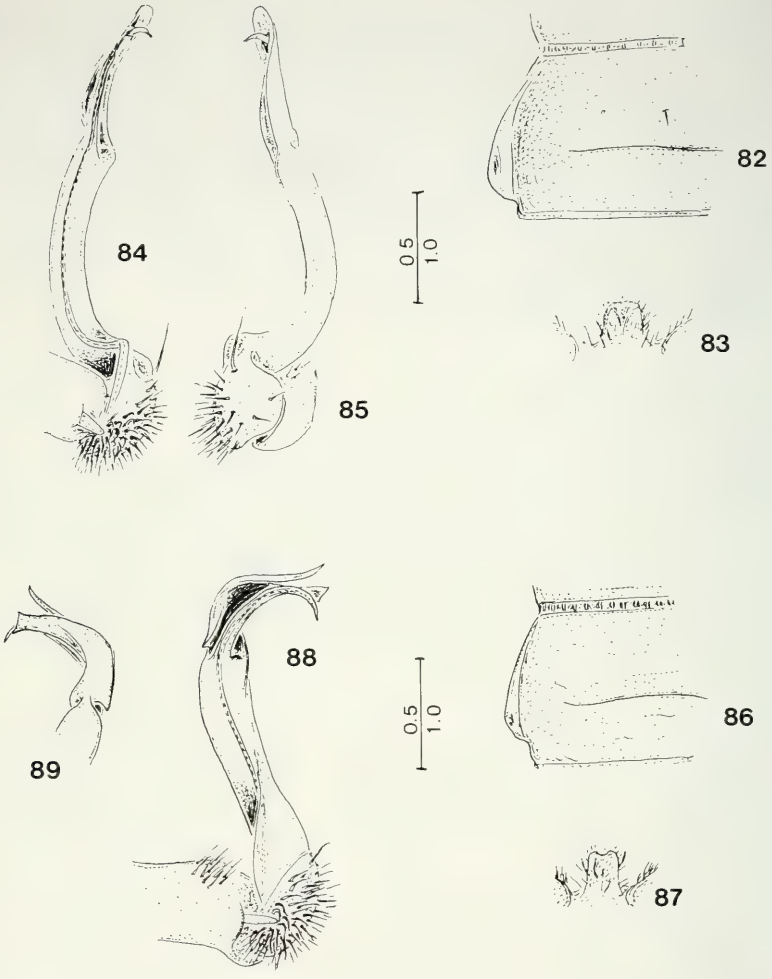
Material: HOLOTYPE ♂ (MHNG), Malaysia, Borneo, Sarawak: Bau, near Cave "Gua Puang" near Kampong Pelaman Sekiang on a steep slope of Gunung Jambusan ("Pang Cave" in Wilford, 1964), 10–30 m, beaten from vegetation, 4.XII.1987 (Sar-87/51); leg. C. Lienhard. – Paratype: ♂ (MHNG), Sarawak: Serian District, Penrissen Road 12 miles from Kuching, Semongok Wildlife Rehabilitation Centre: Nursery Centre of the Forest Department, 20–50 m, 8.XII.1987 (Sar-87/61); leg. B. Hauser.

Diagnosis: Differs from congeners by the distinctly and deeply bifid gonopod tibiotarsus as well as by the considerably shorter gonofemorite.

DESCRIPTION

Length ca. 23-26 mm, maximal width 1.9-1.95 and 2.1-2.2 mm on midbody pro- and metazonites, respectively. Coloration contrasting, being blackish dorsally down to level of paraterga and yellow-whitish below; head, almost entire antennae, epiproct and tips of tarsi pale brownish to brown; tip of antenna whitish, most of antennomere 7 blackish.

Head a bit broader than somite 5 and subequal in width to somite 7, much broader than subequally wide collum and somite 2 and, especially, narrowest somites 3-4. Body parallel-sided on pore-bearing somites (from 7th until 17th), caudally tapering. Antennae relatively long and slender, in situ extending beyond somite 4 dorsally. Paraterga very poorly developed, invariably low (at about body midheight), as a narrow ridge within rear contour only on somite 2, as very poorly developed carinae on somites 3-4, onward as bulges (pore-bearing) or thin (poreless), hardly traceable, vestigial ridges outlined only dorsally due to a sulcus, gradually reducing in size on somites 17-19, caudally always rounded and lying well within rear tergal contour (Fig. 86). Ozopores big, lateral. Surface delicately shagreened almost throughout, shining, polished only on metaterga, slightly rugulose only near fore margin of collum and more coarsely shagreened below paraterga 2–4. Only collum with some traces of an axial line. Somites not very deeply constricted, suture dividing pro- and metazona relatively shallow, strongly longitudinally striate dorsally and dorsolaterally. Transverse metatergal sulcus starting as barely traceable from somite



FIGS 82-89

Opisthodolichopus scandens Hoffman, 1973, ♂ (82-85), and *Opisthodolichopus bifidus* sp. n., ♂ paratype (86-89): 82 & 86 – somite 10, dorsal view; 83 & 87 – sternal lamina between ♂ coxae 4, caudal view; 84-89 – left gonopod, mesal, lateral, mesal, and lateral views, resp. – Scales in mm.

5, onward more deep, thin, lineiform, rather short, far from reaching to bases of paraterga, missing on somites 18-19. Tergal setae short, mostly broken off, a few on collum and 1+1 on somite 2, setation pattern perhaps 1+1 or 2+2 in a presulcus row. Pleurosternal carinae as a lappet on somite 2, an oblique low ridge on somites 3-4, an incomplete ridge hardly traceable only caudally on somites 5-6, onward totally

missing, never extending beyond rear contour. Epiproct long, flattened dorsoventrally, in lateral view almost straight, from above rather broadly truncate, distal half parallel-sided, preapical incisions distinct and placed close to tip, apical papillae indistinct. Subanal scale semicircular, with a pair of setiferous, paramedian knobs at a convex caudal margin.

Sterna moderately densely setose, without modifications, with a prominent, linguiform, setose, apically slightly emarginate lamina directed mainly ventrally between coxae 4 (Fig. 87). Legs long, slender, gradually growing in length toward caudal body end, perhaps a little incrassate, with neither adenostyles nor tarsal brushes, setation generally sparse to modest, mainly ventral, somewhat more dense only on coxa, prefemur and tarsus, last two especially long and more strongly enlarged.

Gonopods (Figs 88-89) simple, elongate. Coxite rather long, distoventrally setose. Prefemoral part little, densely setose as usual. Femorite relatively short, subcylindrical, folded mesally near base. Both tibiotarsus and solenomerite long and slender, subequal in length, former deeply bifid.

Remarks: The deeply bifid gonopod tibiotarsus coupled with the relatively short gonofemorite make the above new species disjunct among congeners. Such a pattern of somewhat more strongly isolated congeners confined to Borneo has already been observed in some other paradoxosomatid genera, e.g. *Gigantomorpha*, *Dajakina* (JEEKEL 1963).

Superficially, judged from a strongly bifid gonopod tibiotarsus, *O. bifidus* somewhat resembles *Antheromorpha* Jeekel, 1968, *Dajakina* as well as some other Oriental genera of the tribe Orthomorphini. However, *O. bifidus* differs by the completely mesal position of the solenomerite and entirely lateral tibiotarsus characteristic of a sundaninine.

All currently known *Opisthodolichopus* species can be separated using the following key:

1(2) Larger: width 3.3 mm. Pleurosternal keels traceable only on somites 2-4 ..... *O. nigricornis*

2(1) Smaller: width at most ca. 2.5 mm. Pleurosternal keels traceable at least until somite 6

3(4) Live coloration carmine-red, in ethanol bleached white with brownish middorsal areas. Pleurosternal keels until ♂ somite 7. Gonopods as in Figs 84-85. ..... *O. scandens*

4(3) Coloration in ethanol always contrasting, being dark blackish-brown dorsally and pinkish to white on sides and ventrally. Pleurosternal keels either until somite 6 or until somite 8. Gonopods different, especially tibiotarsus.

5(6) Pleurosternal keels extending back to ♂ somite 8. Gonopod tibiotarsus slender, laminate. Java. ..... *O. javanicus*

6(5) Pleurosternal keels extending back only to ♂ somite 6. Gonopod tibiotarsus much more stout, either strongly bifid or broadly laminate.

7(8) Sides and ventrum in ethanol pinkish. Gonopod tibiotarsus broadly laminate. Sumatra. ..... *O. thienemanni*

8(7) Sides and ventrum in ethanol whitish. Gonopod tibiotarsus deeply bifid. Borneo. ..... *O. bifidus*

Arthrogonopus proletarius sp. n. (Figs 90–93)

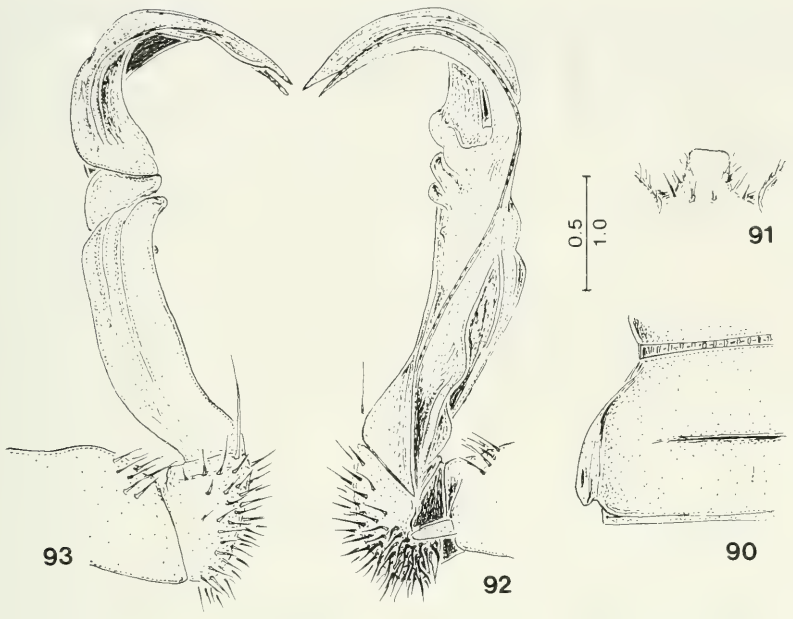
Material: Holotype ♂ (NHMB), Indonesia, Borneo, Kalimantan Barat: Gunung Palung National Park, Caban Panti Research Site (1°13'S, 110°7'E), primary lowland rainforest, under bark, 20.VII.1993; leg. O. Merkl.

Diagnosis: Differs from congeners by the caudally dentate paraterga combined with the relatively well-developed pleurosternal carinae (present as knobs even on somite 8) as well as the pointed, non-branching and long gonopod tibiotarsus.

Description

Length ca. 38 mm, maximal width 2.5 and 3.0 mm on midbody pro- and metazonites, respectively. Coloration generally blackish-brown; a wide, moniliform, yellowish, axial stripe on dorsum extending to epiproct (especially wide and bright on prozonites and rear half of metazonites, more brownish on frontal half of metazonites); antenna black, only tip whitish; head, paraterga, suture dividing pro- and metazonites as well as ventrum and a few distal podomeres (mostly postfemur, tibia and tarsus, more closely to telson also femur) pale brownish; proximal podomeres whitish-yellow; tibiae and tarsi of last two legpairs considerably infuscate as compared to those of preceding legs.

Head a bit narrower than subequally wide somites 5-16, but broader than collum and, especially, narrowest somites 3-4. Body gently and gradually tapering caudad on somites 18-20. Antennae very long and slender, in situ extending beyond somite 5 dorsally. Paraterga very poorly developed, invariably low, as a narrow ridge extending caudally beyond rear contour only on somite 2, onward as thick (pore-bearing) or thin (poreless) ridges outlined only dorsally due to a sulcus, gradually reduced in size on somites 17-19, caudally almost beak-shaped, very narrowly rounded from somite 5 (Fig. 90). Ozopores big, lateral. Surface delicately shagreened throughout, generally dull, poorly shining only on metaterga, rugulose only below paraterga, some metaterga with traces of an axial line. Somites deeply constricted, suture dividing pro- and metazona deep, strongly striate longitudinally. Transverse metatergal sulcus stalting from somite 5, rather deep, thin and lineiform, at bottom vaguely beaded, missing on somites 18-19. Tergal setae short, mostly broken off, a few on collum, pattern perhaps 2+2 in a presulcus row. Pleurosternal carinae as strong caudal teeth extending beyond rear contour on somites 2-6, as a moderately strong tooth lying within the contour on somite 7, as a little knob on somite 8, onward virtually wanting. Epiproct long, flattened dorsoventrally, in lateral view almost straight, from above rather broadly truncate, distal half parallel-sided, preapical incisions distinct and not greatly removed from tip. Subanal scale subtrapeziform, with a pair of setiferous, paramedian knobs at a very poorly convex caudal margin.



FIGS 90-93

Arthrogonopus proletarius sp. n., ♂ holotype: 90 – somite 10, dorsal view; 91 – sternal lamina between ♂ coxae 4, caudal view; 92-93 – right gonopod, mesal and lateral views, resp. – Scales in mm.

Sterna poorly setose, without modifications, with a big, trapeziform, setose lamina directed mainly ventrally between coxae 4 (Fig. 91). Legs long, slender, with neither adenostyles nor tarsal brushes, setation sparse, mainly ventral, somewhat more dense only on coxa, prefemur and tarsus.

Gonopods (Figs 92–93) subfalcate. Coxite rather long, ventrally setose. Prefemoral part small, densely setose as usual. Femorite rather long, folded laterally and, especially, mesally; postfemoral portion set off due to well-developed lateral sulcus, with a couple of little knobs distoventrally. Both tibiotarsus and solenomerite long and slender, subequal in length, pointed.

Remarks: The genus *Arthrogonopus* Jeekel, 1963, has hitherto been considered as being endemic to Borneo, with five species involved: *A. edentulus* Jeekel, 1963 (the type-species), *A. denticulatus* Jeekel, 1963, *A. borneonus* (Attems 1931), *A. bifidus* Jeekel, 1963, and *A. vicinus* Jeekel, 1983b (JEEKEL 1963, 1983b). The above new species is a typical congener, failing to alter the generic diagnosis.

The record of *A. borneonus* (as *Orthomorpha borneona* Attems, 1930, sic!) in Singapore by WANG & TANG (1965) is dubious and most probably erroneous, reason why JEEKEL (1968) as usual ignored it altogether (see also above and below).

Eventually, WANG & TANG (1965) could well have dealt with *Opisthodolichopus scandens* Hoffman, 1973, the only species of the tribe Sundaninini subsequently reported from Singapore (see also above).

All currently known *Arthrogonopus* species can be separated using the following key:

1(2) Coloration of two last legpairs not differing from that of other legs. Gonopod tibiotarsus with a big, laminate, midway, distolateral process. ..... *A. bifidus*

2(1) Last two legpairs contrastingly infuscate at least distally of middle of tibiae, more proximally yellowish-brown, remaining legs brown only in distal halves of tarsi. Gonopod tibiotarsus devoid of a considerable process.

3(6) Even ♂ poriferous paraterga largely fully and more or less strongly rounded caudally, at most subangular, never beak-shaped even on posteriormost somites.

4(5) Pleurosternal keels present on somites 2-8. Gonopod femorite and postfemoral part each with a distoventral knob. ..... *A. borneonus*

5(4) Pleurosternal keels only on somites 2-6(7). Gonopod femorite, not postfemur, without distoventral knob. ..... *A. edentulus*

6(3) At least a few posteriormost paraterga dentiform caudally (Fig. 90).

7(8) Paraterga relatively poorly developed, growing subangular only toward posterior somites, distinctly angular only on somites 17-18. Pleurosternal keels traceable only until ♂ somite 6. Gonopod tibiotarsus always devoid of a distal tooth, acuminate. ..... *A. vicinus*

8(9) Paraterga subdentiform caudally at least from somite 15 onward. Pleurosternal keels present also also on ♂ somite 7. Gonopod tibiotarsus sometimes rounded apically and bearing a distal tooth.

9(10) Paraterga strongly angular, almost dentiform from somite 5 onward (Fig. 90). Pleurosternal keels traceable until ♂ somite 8. Gonopod tibiotarsus acuminate at end, devoid of a distal tooth (Figs 92–93). ..... *A. proletarius*

10(9) Paraterga produced into minute denticles caudally on somites of posterior body half. Pleurosternal keels traceable only until ♂ somite 7. Gonopod tibiotarsus with a rounded apical lappet and a distal tooth. ..... *A. denticulatus*

Margaritosoma borneorum sp. n. (Figs 94–101)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah, Interior Residency, Kimanis road, 16 mi from Keningau, heliport, 1400 m, mossy forest, beaten from vegetation, 14.III.1983 (Pal-83/14); leg. C. Lienhard. – Paratypes: 1 ♀ (MHNG), same locality, together with holotype. – 1 ♂ (MHNG), Sabah, Interior Residency, Kimanis road, 10 mi from Keningau, 1170 m, secondary forest, beaten from vegetation, 13.V.1982 (82187). – 1 ♀ (MHNG), Sabah, Interior Residency, Kimanis road, 16 mi from Keningau, heliport, 1380-1400 m, mossy forest, beaten from vegetation, 12.V.1982 (82178); all leg. D. Burckhardt. – 1 ♂, 1 ♀ (MHNG), 1 ♂ (ZMUM), Borneo, Brunei, Belait Distr., "Badas Forest Reserve", ca. 10 km along secondary road branching 32 km of Kuala Belait toward S, 10 m, "Kerangas" forest (=

tropical heath forest) mostly of *Agathis damnara* (Lambert) L.G. Rich. (Araucariaceae), under bark, 23.XI.1988 (Bru-88/36). – 2 ♀♀ (MHNG), Borneo, Brunei, Belait Distr., "Andulau Forest Reserve", 3.5 km S of Sungaim Liang (ca. 39.5 km from Labi), mixed dipterocarp forest, "K-7", beaten from vegetation, 19.XI.1988 (Bru-88/22). – 1 ♀ (MHNG), Borneo, Brunei, Belait Distr., "Labi Hills Forest Reserve", "Teraja", 42 km S of Sungai Liang (= 12 km S of Labi), near "Rumah Panjang" (= Longhouse of Kampong Teraja), mixed dipterocarp forest, 40 m, beaten from vegetation, 22.XI.1988 (Bru-88/33); all leg. C. Lienhard.

Etymology: The species epithet emphasizes the first congener encountered on Borneo.

Diagnosis: Differs from congeners both by the especially poorly developed paraterga and by the shape of the gonopod tibiotarsus.

Description

Length ca. 11-12 (♂) and 14-15 mm (♀), maximal width of midbody somites 0.85-0.95 (♂) and 1.0–1.05 mm (♀). Coloration uniform red- to chocolate-brown, body caudally somewhat more pale; only tip of antennae, suture between pro- and metazona, and legs whitish to yellowish.

Head a little broader than subequally wide collum and midbody somites, postcollar constriction slight on subequally narrowest somites 2-3. Body distinctly moniliform, parallel-sided on somites 5-16, onward very gently and gradually tapering. Antennae moderately long, slightly clavate, in situ reaching to end (♂) or midlength (♀) of somite 4. Collum with a lateral rim. Paraterga very weakly displayed as small and low ridges slightly delimited from above and below on somites 2-4 (Fig. 94), onward entirely missing. Ozopores lying very low, surmounting small swellings (Fig. 95). Surface shining, smooth. Somites strongly constricted, suture dividing pro- and metazona deep, extremely strongly striate longitudinally. Metatergal sulcus virtually missing, only sometimes poorly traceable on somites 2-3 (♀). Axial line wanting. Tergal setae rather short to medium-sized, a few on collum, onward a pattern of 2–3+2–3 and sometimes also 2–3+2–3 setae discarding a peculiar caudal seta level to ozopore on each side (Fig. 95). Setae of rear row often incomplete to virtually missing (especially so in Brunei samples). Pleurosternal carinae strong and dentiform on somites 2–3, weak on somite 4, onward obsolete. Epiproct medium-sized, somewhat flattened dorsoventrally, narrowly truncate at apex, lateral incisions strongly removed from tip. Subanal scale trapeziform, with a pair of rather distinct, setiferous, paramedian knobs at caudal corners.

Sterna usual, without modifications, sparsely to modestly setose, strongly shining, with a big, transverse, setose, deeply notched lamina directed ventrad between ♂ coxae 4 (Fig. 96). Legs rather long, somewhat incrassate and more long in ♂ as compared to ♀, with neither adenostyles nor tarsal brushes.

Gonopods (Figs 97-101) rather stout. Coxite not too long, distoventrally setose. Telopodite without evidence of torsion, prefemoral part rather prominent, femorite with a mesal groove and a more (Sabah) or less (Brunei) strongly rounded, dorsal, midway lobe. Lamina medialis of tibiotarsus unciform apically, with a small simple tooth well removed from a more or less slender tip. Lamina lateralis little, ribbon-shaped, more or less strongly bent. Distolateral process of tibiotarsus strong, simple, more or less ribbon-shaped, bent subapically. Seminal groove entirely mesal.

Margaritosoma singaporense sp. n. (Figs 102–105)

Material: Holotype ♂ (MHNG), Singapore, "Island Country Club", between Lower Peirce Reservoir and Windsor Park Estate along Upper Thomson Road, remains of primary forest surrounded by secondary forest, ca. 60 m, beaten from vegetation, 12.XI.1988 (Bru-88/2); leg. C. Lienhard.

Etymology: The species epithet refers to the terra typica.

Diagnosis: Differs from congeners both by the relatively poorly developed, distinctly incised paraterga and by the peculiar shape of the gonopod tibiotarsus.

Description

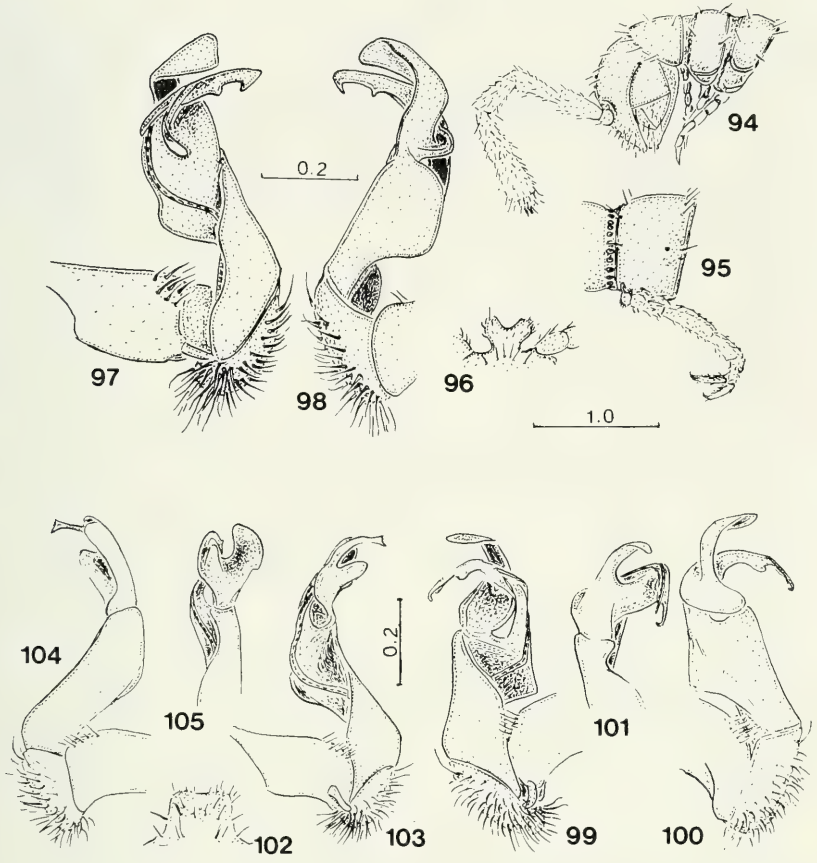
Habitus much like in *M. borneorum*, but differing as follows. Length ca. 11-12 mm, maximal width 0.8 mm on midbody somites. Coloration uniform pale brown, anterior third of body a little brighter, only legs and suture dividing pro- and metazona whitish, and antennomere 7 a little infuscate.

Head subequal in width to somites 5-15, a bit broader than subequally wide collum and somites 2-4. Body distinctly moniliform, very gradually and gently tapering caudad on somites 16–20. Paraterga almost entirely missing, very weakly displayed as small and low ridges on somite 2, hardly traceable due to outlining sulci from above and below only on somites 3-4, onward virtually missing, preserved only as poor swellings. Paraterga 2-3 with three, paraterga 4 with two distinct, lateral, setiferous incisions. Ozopores very low, surmounting the swellings. Transverse metatergal sulcus entirely missing. Tergal setae relatively long, ca. 1.5 times as long as in *M. borneorum*; pattern much like in *M. borneorum* as well, a few on collum, onward 3-4+3-4 and 4+4 setae in two rows, discarding 1-2 peculiar setae behind ozopore until somite 7. Pleurosternal keels vestigial on somites 2-4, onward absent. Epiproct rather long, from above almost parallel-sided, broadly subtruncate, with preapical incisions well-developed and rather strongly removed from tip. Subanal scale low, broadly trapeziform, with a pair of indistinct, setiferous, paramedian knobs at a wide and straight caudal margin.

A big, subtrapeziform, setose lamina directed obliquely anteventrad between ♂ coxae 4 (Fig. 102).

Gonopods (Figs 103-105) less strongly curved, midway dorsal lobe on femorite almost wanting. Lamina medialis with a prominent rounded lobe at basal 1/3, distolateral process of tibiotarsus big and scapuliform.

Remarks: Wang (1967b) once reported *Tectoporus filum* (Silvestri) from Singapore, a species originally very poorly described from Sumatra and presently known to be the generotype of *Margaritosoma* Jeekel, 1979, only since its relatively recent redescription (Jeekel 1979a). Why that species had been reallocated in *Tectoporus* by Wang & Tang (1965), remains totally obscure, the most likely reason why Jeekel (1968, 1979a) simply ignored both record and transfer altogether. What seems more important, however, is that Wang's discovery could have well belonged in fact to *M. singaporense*. Hence the entire situation strongly reminds of Wang's records of *Orthomorpha* and/or *Gigantomorpha* in Singapore (see above).



FIGS 94-105

Margaritosoma borneorum sp. n. (94-101), ♂♂ paratypes from Sabah (94-98) and Brunei (99-101), and *Margaritosoma singaporense* sp. n. (102-105), ♂ holotype: 94 – anterior body portion, lateral view; 95 – somite 10, lateral view; 96 & 102 – sternal lamina between ♂ coxae 4, caudal view (96 drawn not to scale); 97-101, 103-105 – gonopods, mesal, lateral, mesal, lateral, mesal, lateral, ventral, and ventral views, resp. – Scales in mm.

The genus *Margaritosoma* Jeekel, 1979a, has hitherto been known to comprise four species: *M. filum* (Silvestri, 1895) (the type-species), from Sumatra, *M. nanum* (Silvestri, 1895), from Enggano, *M. sequens* (Chamberlin, 1945), from Java, and *M. baliorum* Golovatch, 1994b, from Bali (JEEKEL 1979a; GOLOVATCH 1994b). Besides, JEEKEL (1979a) mentioned one more, yet undescribed congener from Padang, Sumatra, suggesting the genus be much more prolific. The above two new species from Borneo and Singapore confirm that statement to some extent, both are typical members virtually failing to broaden the concept of the genus concerned.

All currently known *Margaritosoma* species can be separated using the following key:

1(2) Transverse sulcus on metaterga present, usual. Paraterga absent, with striae in their stead. Distolateral process of gonopod tibiotarsus especially slender, a little longer than solenophore. Java. . . . . *M. sequens*

2(1) Transverse sulcus on metaterga virtually absent. Somites 5–15 without any traces of paraterga. Distolateral process of gonopod tibiotarsus shorter than solenophore.

3(4) At least most ♂ sterna with a little cone near coxa, lamina between ♂ coxae 4 fully bipartite. Gonopod tibiotarsus relatively little, only ca. 1/3 as long as femorite. Bali. . . . . *M. baliorum*

4(3) Sterna without modifications, lamina between ♂ coxae 4 always as a single piece, usually lingui- to subtrapeziform. Gonopod tibiotarsus always bigger and longer, closer to 1/2 as long as femorite.

5(6) Tergal setae especially numerous, largely 3+3 and 8+8 in two transverse rows. Suture dividing pro- and metasomites not especially strongly ribbed. Distolateral process of gonopod tibiotarsus oblong blade-like. Enggano. . . . . *M. nanum*

6(5) Tergal setae less numerous. Suture dividing pro- and metasomites very strongly ribbed (Fig. 95). Distolateral process of gonopod tibiotarsus either as a very broad lobe or ribbon-shaped.

7(8) Head considerably broader than collum. Tergal setae largely 4(5)+4(5) and 6+6 in two transverse rows. Sternal lamina between ♂ coxae 4 high, linguiform. Tarsal brushes present until two last ♂ legpairs. Sumatra. . . . . *M. filum*

8(7) Head only a little broader than collum. Tergal setae less numerous. Sternal lamina neither too high nor linguiform. Tarsal brushes virtually absent.

9(10) Paraterga 2-4 quite strongly incised. Tergal setae largely 3(4)+3(4) and 4(5)+4(5) in two transverse rows. Sternal lamina between ♂ coxae 4 subtrapeziform (Fig. 102). Distolateral process of gonopod tibiotarsus scapuliform (Figs 103-105). Singapore. . . . . *M. singaporense*

10(9) Paraterga 2-4 only with very vague incisions at lateral margin. Tergal setae usually either as 2(3)+2(3) and 3(4)+3(4) in two rows (Fig. 95) or rear row up to (almost) entirely reduced. Sternal lamina between ♂ coxae 4 strongly emarginate apically (Fig. 96). Distolateral process of gonopod tibiotarsus ribbon-shaped (Figs 97-101). Borneo. . . . . *M. borneorum*

KEY TO PARADOXOSOMATID TRIBES AND GENERA ENCOUNTERED ON BORNEO, WITH A REVIEW OF THE BORNEAN FAUNA:

1(2) Body strongly polydesmoid; paraterga very prominent, devoid of lateral calluses; ozopores located below paraterga. Males yet unknown . . . . . Tribe Centrodesmini

Genus *Pleuroporodesmus* Jeekel, 1983a. Only a single species from East Borneo is known: *P. serrulatus* Jeekel, 1983a.

2(1) Body not so strongly polydesmoid; when paraterga prominent, lateral calluses always strongly developed; ozopores always on paratergal calluses. Males known.

3(6) Gonopod prefemorite hypertrophied; solenomerite not flagelliform, very thick and rigid, completely or mostly free from solenophore-like structures, if any. . . . . Tribe Antichiropodini

4(5) Seminal groove passing onto solenomerite on dorsal side of distalmost femorite (Figs 40-41). . . . . Genus *Borneochiropus* n. A single species from East Borneo.

5(4) Seminal groove passing onto solenomerite on ventral side of distalmost femorite (Figs 16, 24, 30, 34). . . . . Genus *Euphyodesmus* Attems, 1931 Seven species, all from West or East Borneo (see key above).

6(3) Gonopod prefemorite never hypertophied, largely usual; solenomerite always flagelliform, slender, mostly closely attached to or sheathed by a well-developed solenophore (= tibiotarsus).

7(8) Gonopod tibiotarsus with a big additional lateral lobe or process (Figs 97–101). Body devoid of paraterga from somite 5 on (Fig. 95) . . . . . Genus *Margaritosoma* Jeekel, 1979a

A single and obviously disjunct genus of the tribe Sulciferini yet encountered on Borneo, the above being only the generic diagnosis. Only one species has been recorded in West and East Borneo, several others are widely scattered in the Sunda area (see key above).

8(7) Gonopod tibiotarsus without such outgrowths. Body always with paraterga also on somites 5-19.

9(16) Solenomerite fully mesal, attached to but not sheathed by a completely lateral solenophore. Paraterga always poorly developed. . . . Tribe Sundaninini

10(13) Gonopod femorite devoid of a marked distal process, at best only poor wrinkles in its place.

11(12) Distal part of gonofemorite with a prominent lateral sulcus marking a postfemoral portion, latter with wrinkles distoventrally (Figs 92–93) . . . . . Genus *Arthrogonopus* Jeekel, 1963 Six species, all from Borneo (see key above).

12(11) Neither sulcus demarcating a gonopostfemoral portion nor traces of a distofemoral outgrowth (Figs 88–89). Genus *Opisthodolichopus* Verhoeff, 1941 A single species yet encountered on Borneo (see key above).

13(10) Gonopod femorite with a more or less prominent process at or near base of solenomerite.

14(15) Gonopod suberect, tibiotarsus shorter than femorite, curved slightly dorsad. . . . . Genus *Borneonina* Jeekel, 1963 A single species from West Borneo: *B. retrorsa* Jeekel, 1963.

15(14) Gonopod subfalcate, especially so due to a long and ventrally curved solenophore (Figs 73–75, 79–81). . . . . Genus *Kalimantanina* Jeekel, 1963

Seven species, all for East and West Borneo (see key above).

16(9) Solenomerite strongly to almost fully sheathed by solenophore, latter consisting of a lamina medialis and a lamina lateralis. Paraterga often very well-developed, subhorizontal. . . . . Tribe Orthomorphini

17(20) Paraterga very well-developed, mostly subhorizontal, close to level to dorsum.

18(19) Paraterga with moderately strong lateral calluses (Figs 56-57). Gonopod femorite with 1–2 distinct, dorsal, parabasal folds; tip of tibiotarsus with a laminate or spiniform outgrowth (Figs. 59-62) . . . . . Genus *Gigantomorpha* Jeekel, 1963

Ten species, of which eight occur on Borneo (see key above).

19(18) Gonopod femorite without dorso-parabasal folds; tip of tibiotarsus as 2-3 minute lappets. . . . . Genus *Orthomorpha* Bollman, 1893

Two species have hitherto been formally reported from Borneo: *O. beaumontii* (Le Guillou, 1841), and *O. coarctata* (de Saussure, 1860). The former taxon is a big form deriving from an unidentified Bornean locality and known only from a single ♀ specimen (see redescription: JEEKEL 1963), whereas the latter congener is much smaller, representing a pantropical anthropochore.

20(17) Paraterga poorly developed, sometimes next to obsolete.

21(22) Gonopod tibiotarsus relatively slender, solenomerite beginning very near to border between femorite and tibiotarsus (Figs 49-53). Gonofemorite sometimes with a dorso-parabasal process or its traces . . . . . Genus *Dajakina* Jeekel, 1963

Five species, of which four occur on Borneo (see key above).

22(21) Gonopod tibiotarsus hypertrophied, solenomerite beginning considerably proximad of border between femorite and tibiotarsus (Figs 49-53). Gonofemorite always without even traces of a dorso-parabasal process . . . . . Genus *Orangutana* n.

A single species from East Borneo.

In addition, the Bornean paradoxosomatid fauma contains a couple of nomina dubia. The first of these represents a species only possibly deriving from Borneo (and/or Sulawesi?): *Strongylosoma kuekenthali* Attems, 1897. While it is clear now that the taxon has nothing to do with a true *Strongylosoma* Brandt, 1833, its identity remains totally obscure. All previous reallocations in *Orthomorpha* or *Oxidus* Cook, 1911 (ATTEMS 1937; JEEKEL 1963, 1968 — to his credit, the latter author always did so with the necessary qualifications) are bound to be useless as well, since the generic position of *S. kuekenthali* can be clarified only upon re-examination of type material.

The same can be said about yet one more Bornean paradoxosomatid, *Strongylosoma nodulosum* Attems, 1897. This species has been described from a single ♀ specimen deriving from a closer unknown locality, thus discouraging any revisionary attempt. Only a study of new abundant materials of Bornean Paradoxosomatidae may reveal samples best matching the holotype of *S. nodulosum*, thus finally offering a solution to the riddle. Yet one must be realistic that eventually this may never happen.

ZOOGEOGRAPHICAL NOTES

Having already been revised once in the scope of the entire Bornean fauna (JEEKEL 1963), the Paradoxosomatidae definitely still remains a highly insufficiently known millipede family in the entire Australasian area. Eventually, the same concerns all Diplopoda in general of almost any region of the world, especially tropical. The current estimates of the real species diversity of the class range between 50,000 to 80,000, of which only some 11-12% seem to have hitherto been described GOLOVATCH et al. 1995). In other words, with 42 acknowledged species from as many as 12 genera presently recorded in Borneo, perhaps several times as many paradoxosomatids can be expected to be ultimately found there.

Of course, the above statement concerns first of all the species level. Already now a number of genera are quite to highly species-rich on Borneo, e.g., *Gigantomorpha*, *Kalimantanina*, *Euphyodesmus*, *Arthrogonopus*. All of such examples but the first seem to represent true Bornean endemics, while *Gigantomorpha* can be regarded subendemic, with the bulk of its constituents being confined to Borneo. A further increase in the number of species to be yet revealed can be anticipated to be largely due to such prolific genera. On the other hand, judged from the present contribution, the number of genera to be discovered on Borneo is likely to at least double, and not only due to some more pantropical/widespread anthropochores like *Chondromorpha xanthotricha* (Attems, 1898), *Oxidus gracilis* (C. L. Koch, 1847), *Desmoxytes planata* (Pocock, 1895), *Anoplodesmus saussurei* (Humbert, 1965) or *Helicorthomorpha orthogona* (Silvestri, 1898).

Yet an outline of Bornean zoogeography as based on the Paradoxosomatidae, highly preliminary as it is, seems justified. Already JEEKEL (1963) noted that Borneo supports "a paradoxosomatid fauna which, although having general southeast Asiatic features, is characterized by a large percentage of endemic genera" (op. cit., p. 205-206). Discarding a few obvious anthropochores, virtually 100% Bornean paradoxosomatid species are endemic there. Zoogeographically, more instructive appear both generic and tribal levels.

If the quantity of indigenous Bornean species or, to a lesser degree, genera is sure to increase very considerably along with future explorations, the number of tribes is more likely to remain more stable and representative. Altogether, five tribes are currently known to occur on Borneo, with the following constituent genera: Antichiropodini (*Euphyodesmus*, *Borneochiropus*), Orthomorphini (*Orthomorpha*, *Gigantomorpha*, *Dajakina*, *Orangutana*), Sundaninini (*Arthrogonopus*, *Opisthodolichopus*, *Kalimantanina*, *Borneonina*), Centrodesmini (*Pleuroporodesmus*), and Sulciferini (*Margaritosoma*). As briefly outlined earlier, the Antichiropodini is a chiefly Australian tribe, with only three genera encountered west of West Australia, viz. the Papuan *Haplochiropus* and the above Bornean *Euphyodesmus* and *Borneochiropus*. The remaining tribes are certainly Asian/Oriental in origin, with the Centrodesmini and the Sundaninini clearly centering in the Sunda area. The obviously disjunct sulciferine *Margaritosoma*, the orthomorphines *Gigantomorpha* and the *weberi*-group of *Orthomorpha*, the sundaninine *Opisthodolichopus* join the examples of endemic

Sunda groups, yet not necessarily strictly Bornean. Hence, together with the truly endemic Bornean elements, first of all probably from the largely Sunda tribe Sundaninini, the paradoxosomatid fauna of that great island is indeed strongly dominated by Oriental elements.

What seems more surprising is a relatively pronounced influence of the Australian realm expressed in the obviously endemic Bornean antichiropodines. Moreover, at least one of these, *Euphyodesmus*, appears a quite species-rich genus. The gap between Borneo and New Guinea, in particular Sulawesi, still harbouring virtually no paradoxosomatids Australian/Papuan in origin, e.g., representing the tribes Antichiropodini and/or Eustrongylosomatini, seems to be an artifact, reflecting the yet highly insufficiently explored faunas of the islands/archipelagos lying in between rather than a complete absence of Australian/Papuan influence in the Sunda area east of Borneo. Only further investigations can refute or confirm that. Until then, the above remains mere speculations.

Similar observations of a mixed nature of the millipede fauna of Australasia, with strong dominance of the Oriental realm up to New Guinea in the east, have been reviewed and confirmed recently by SIMONSEN (1990, 1992). Yet there seems to be no reason whatever to explain the modern distribution patterns of the millipedes of the Sunda area in terms of continental drift and Gondwana fragmentation since the Permo-Triassic (criticism of the so-called "mobilistic biogeography" see in: ESKOV & GOLOVATCH 1986). All currently known evidence of the biogeography of Australasian Diplopoda seems to point that the gigantic archipelago in question, both Borneo and New Guinea included, definitely belongs to the Oriental Region, alghough the reciprocal influence of the Australian realm is more or less strongly traceable there as well (cp. GRESSITT 1961). As regards the Paradoxosomatidae, the abovementioned relatively pronounced share of Australian/Papuan components on Borneo suggests an even greater proportion of such forms further to the east. The little that remains to do to prove or disprove this opinion, is to adequately describe at least the Sulawesi fauna which, unfortunately, is still almost unknown.

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